

Multi-Axis Controllers and Drives

High Performance Computing and Control

SEC-AC-SMLC Multi-Axis Controllers

- Integrated PLC functionality and OPC server
- Control up to 16 axes
- Ethernet connectivity and optional Profibus® master variant
- IEC 61131-3 applications programming
- PLCopen and enhanced motion function blocks



SEC-SDD ServoWire® Digital Drives

- IEEE 1394 ServoWire® drive network
- Simplified servo system tuning
- 115 VAC single phase and 230 VAC single/three phase
- Supports both resolver and incremental encoder feedback
- Position loop update rates up to 2 kHz



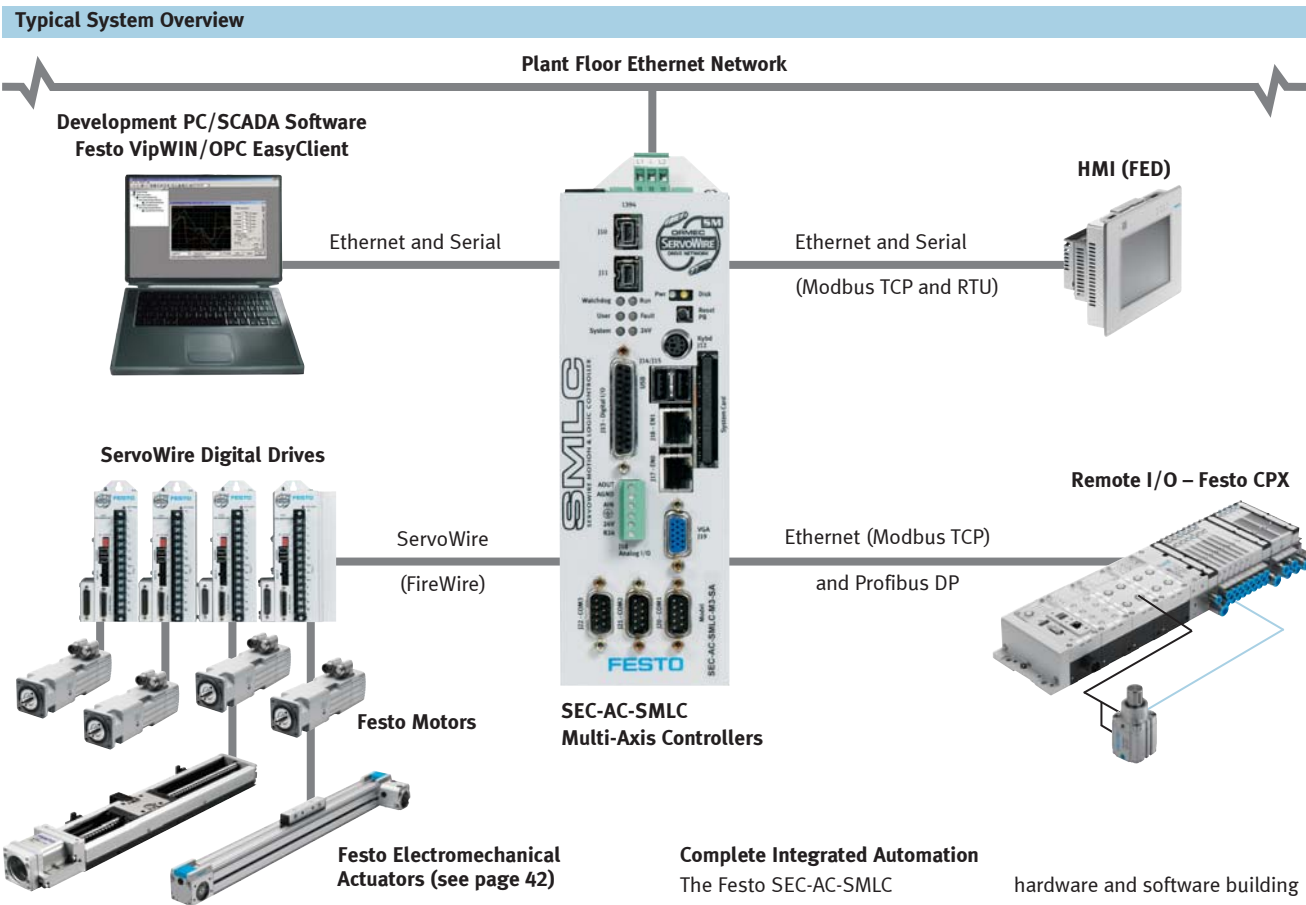
Applications

- Circular, linear and helical interpolation
- Reciprocating flying shear
- Electronic gearing, cams and profiling, registration control
- Rotary knife cut-off and cut to length
- Coordinated multi-axis control



System Overview

Multi-Axis Controllers and Drives



ServoWire® is a registered trademark of ORMEC Systems Corporation. All other product names are trademarks or registered trademarks of their respective holders.

Complete Integrated Automation

The Festo SEC-AC-SMLC Multi-Axis Controller is at the center of a complete solution that can meet all of your motion control, logic, and I/O needs. The SMLC is a fully-integrated control solution, providing

hardware and software building blocks that are engineered to easily plug together and work as a system. This allows engineers to focus on solving their application instead of integrating control components.

SEC-AC-SMLC Multi-Axis Controllers



SEC-AC-SMLC Controllers support the following platforms and standards.



SEC-SDD SermoWire® Digital Drives



SEC-SDD SermoWire Digital Drives support the following platforms and standards.



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Multi-Axis Controllers and Drives

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Online Literature

Literature in PDF format is available for download at www.festo.com/us/m&c/smlc.

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Product Overview

SEC-AC-SMLC Multi-Axis Controllers and SEC-SDD ServoWire® Digital Drives

A Complete Motion Control Solution

Control of up to 16 Axes

The SEC-AC-SMLC with the ServoWire® Drive Network and Modbus TCP communications provide state-of-the-art I/O and motion control, all programmed using the CoDeSys IEC 61131-3 standard languages, controlling up to a maximum of 16 axes.

High Performance Computing

The SEC-AC-SMLC Controller features high performance computing capability combined with a true real-time operating system (RTOS). Using the industry standard family of Intel 32-bit processors to run the QNX RTOS provides plenty of cost-effective, robust computing power for even the most demanding multi-axis motion and I/O control applications.

Flexible Machine and Integrated Drive I/O Capabilities

The SEC-AC-SMLC provides a flexible approach to meeting machine I/O requirements. It offers a unique ability to interface with high-speed drive based I/O. General purpose I/O options are fully supported using Modbus TCP (to Festo CPX-FEC). A wide variety of analog and digital I/O modules as well as valves can be cost-effectively connected to and controlled by the SEC-AC-SMLC. Variants with integrated Profibus® master (for up to 16 axes) are also available.

ServoWire® Drive Network

Festo AC brushless servo motors (MTR-AC) and ServoWire digital servo drives (SEC-SDD) offer tested and guaranteed performance with the SEC-AC-SMLC. Full digital control offers compelling benefits – eliminating manual drive setup and providing real-time software access to all parameters. In a SEC-AC-SMLC system, the position, velocity and torque loops are all closed by the digital signal processors (DSPs) in the ServoWire Drives, based on commands sent from the SEC-AC-SMLC controller.

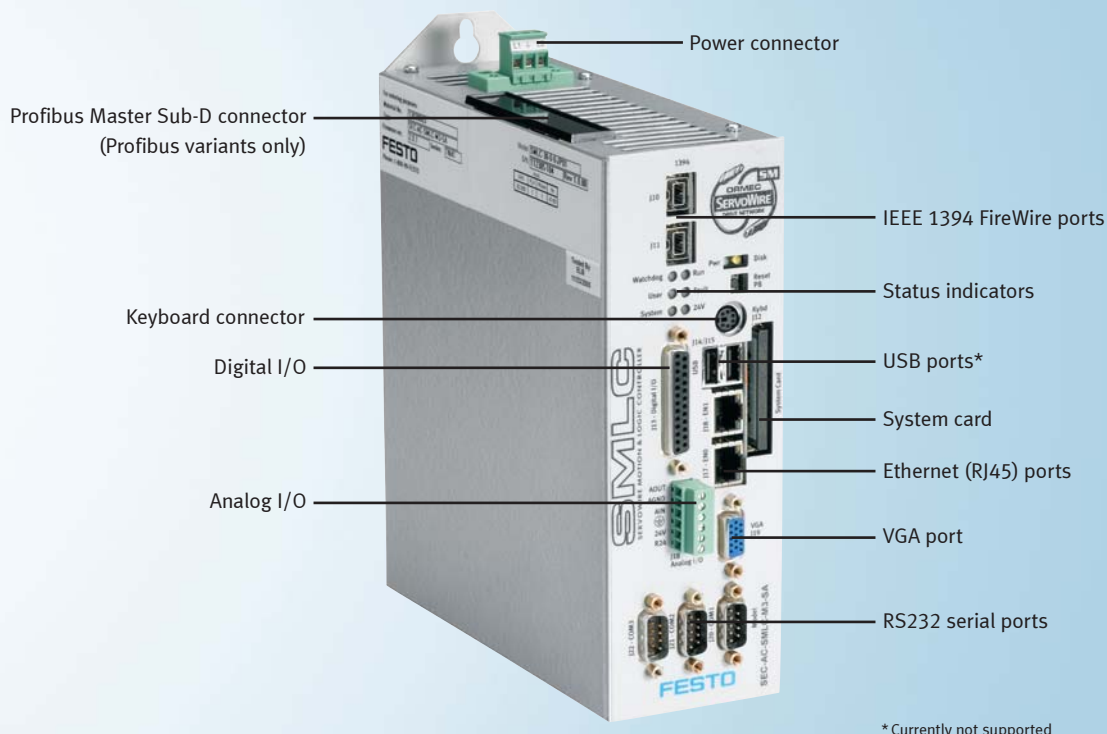


Product Overview

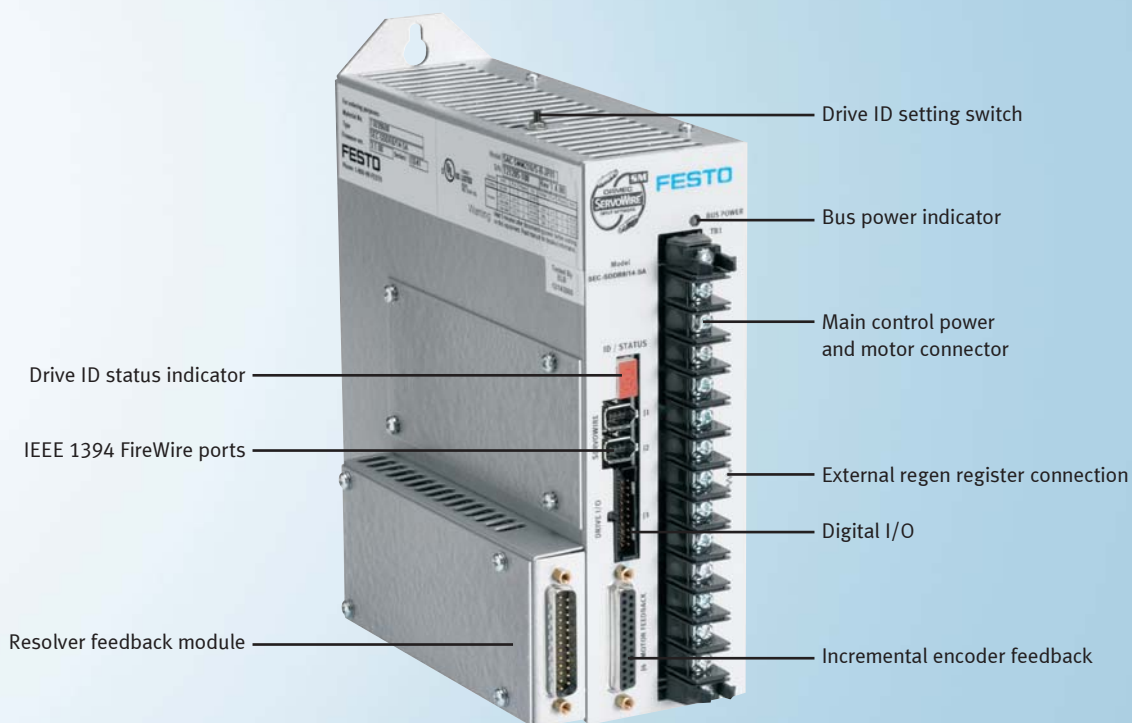
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SEC-AC-SMLC Multi-Axis Controllers and SEC-SDD ServoWire® Digital Drives

Multi-Axis Controller, Type SEC-AC-SMLC



ServoWire Digital Drive, Type SEC-SDD



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Integration

- The SEC-AC-SMLC multi-axis controller and CoDeSys development software combine to provide flexible and effective networking solutions for interfacing machine I/O, HMIs and factory data networks.
- The controller seamlessly integrates with HMI devices using Modbus RTU and Modbus TCP communications.
- The controller also lets users utilize Windows based HMIs such as Wonderware InTouch, Rockwell Automation RS View, Intellution iFIX, CiTect or GE Cimplicity to communicate with the SMLC via OPC Server. The variables in the SMLC can be interfaced to these software programs using Ethernet or Serial communications. OPC provides open, interoperable connectivity for automation and the enterprise systems used in industrial applications.
- Interoperability is assured by the creation and the maintenance of open standards and specifications, by an independent organization that includes both users and manufacturers of industrial automation equipment. The CoDeSys OPC server is included with CoDeSys at no additional charge and includes tools for assigning the SMLC name and IP address, selecting the group of variables to be accessible through the server, refreshing properties, etc.
- The SMLC multi-axis controller provides two Ethernet ports (TCP/IP). CoDeSys includes all the software necessary for communications via Ethernet TCP/IP, enabling easy access to the SMLC from any system connected to the network. This capability allows users to easily implement remote debug and diagnostic capabilities without the need to purchase additional software.

Computing Power

- Using Intel 32-bit processors provides powerful computing capabilities for the most demanding multi-axis motion and I/O control applications.
- QNX Real Time Operating System (RTOS) provides real time reliability and robust performance.

Standardization

- Uses open standard communications technologies
 - Ethernet (TCP/IP)
 - Modbus TCP
 - Profibus DP
 - OPC Server
 - Drive network based on IEEE 1394 FireWire
 All provide flexible interfaces for connecting to general purpose I/O, HMIs and factory data networks.
- The SEC-AC-SMLC Multi-axis controllers and SEC-SDD ServoWire digital drives are CE compliant and UL certified.

Flexibility

- Developing motion and I/O programming with a standard set of software tools provided by CoDeSys IEC61131-3 development software and PLCopen motion function blocks (together with ORMEC enhanced motion library) streamlines software development and creates application programs that are more effective and easier to support in the field.
- Pre-programmed function blocks allow for CPX-FEC communications over Modbus TCP.
- Reusable function blocks reduce engineering/programming time, thereby reducing system development costs.



SEC-AC-SMLC Controllers

Three models available with two variants each

- 3-Axis
- 8-Axis
- 16-Axis

An integrated Profibus master variant is available for all three controller models

Technical Data – Electrical

SEC-AC-SMLC Multi-Axis Controllers

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Integrated Features

- PLC functionality
- OPC Server
- Digital and Analog inputs and outputs
- Three RS232 serial ports (four on the M16 model)

Drive Network

- High bandwidth synchronous, all digital servo drive network based on IEEE 1394 (2 ports)

Networking

- Two Ethernet 10/100 base T, RJ45 ports supporting Ethernet TCP/IP for connection to factory data networks. Modbus TCP for connecting up to 16 CPX-FEC valve terminals and HMI devices.



Controller Specifications		3-Axis	8-Axis	16-Axis
Type		SEC-AC-SMLC-M3-SA SEC-AC-SMLC-M3-PB-SA	SEC-AC-SMLC-M8-SA SEC-AC-SMLC-M8-PB-SA	SEC-AC-SMLC-M16-SA SEC-AC-SMLC-M16-PB-SA
CPU Processor		650 MHz Celeron	933 MHz Pentium III	1.4 GHz Pentium M
Total controller memory		128 MB DRAM		
SMLC program memory / system card		128 MB removable compact flash		
Non-volatile variable memory		32 KB battery backed SRAM		
Input AC Power Ratings				
SEC-AC-SMLC controller		115 VAC (90 to 127 VAC); 47 to 63 Hz 230 VAC (190 to 253 VAC); 47 to 63 Hz		
Battery Power				
Main processor – BIOS		One lithium battery		
Battery backed SRAM		One BR2032 lithium battery (3 volt, 190 mAh)		
Data retention		10 years of data retention, powered. 1 year minimum, 5 year typical, unpowered.		
Digital I/O Power Requirements				
VIO+	VDC	4.5 to 27		
VIO-		Not internally tied to SMLC ground (externally tie to ground)		
Digital Inputs; 8				
Current (switch on)	mA (min)	0.7		
	mA (max)	7.0		
Common VIO+		Inputs sink to VIO-		
Voltage (max)	VDC	VIO+ + 5		
Digital Outputs; 8				
Maximum sink current	mA	33		
Low level voltage	VDC	1.2		
High level voltage	VDC	VIO+ -0.5		
Voltage (max)	VDC	27		
Analog Input, 1 Channel				
Input range	VDC	+10 to -10		
Analog Output, 1 Channel				
Output range	VDC	+10 to -10		
Update rate		Once per scan		
Output settling time	μs	20		
Output current (max)	mA	10		
I/O Connection				
Digital I/O		Sub-D 25-pin female		
Analog I/O		6-pin clamp connector		

Serial Interface Specifications	
Development Port COM1	
Connector	9-pin male Sub-D
Standards	EIA RS-232C
Default configuration	8 data bits 1 stop bit no parity
Baud rate	9600, 4800, 2400, 1200 Baud; 115.2 kB, 57.6 kB, 38.4 kB, 19.2 kB (Default)
HMI Serial Port COM2	
Connector	9-pin Male Sub-D
Standards	EIA RS-232C
Default configuration	8 data bits 1 stop bit no parity
Baud rate	9600, 4800, 2400, 1200 Baud; 115.2 kB, 57.6 kB, 38.4 kB, 19.2 kB (Default)
Serial Ports COM3 and COM4 ¹⁾	
Connector	9-pin Male Sub-D
Standards	EIA RS-232C
Default configuration	8 data bits 1 stop bit no parity
Baud rate	9600, 4800, 2400, 1200 Baud; 115.2 kB, 57.6 kB, 38.4 kB, 19.2 kB (Default)

1) COM4 is only available with model M16.

Certification	
	c UL us - Listed
	89/336/EEC (EMC) 73/23/ECC (low voltage)

Profibus DP Specifications	
For SEC-AC-SMLC-M...-PB-SA Versions Only	
Bus connection	Sub-D 9-pin female
Fieldbus baud rates	Up to 12 MB

Operating and Environmental Conditions	
All Models	
Operating temperature	0 to 50 °C / 32 to 122 °F
Storage temperature	-25 to 70 °C / -13 to 158 °F
Relative humidity	10% to 95% at 40 °C, non condensing
Mounting and airflow	Mounting must be in the vertical position, airflow must be unrestricted

Weights	3-Axis	8-Axis	16-Axis
Type	SEC-AC-SMLC-M3-SA SEC-AC-SMLC-M3-PB-SA	SEC-AC-SMLC-M8-SA SEC-AC-SMLC-M8-PB-SA	SEC-AC-SMLC-M16-SA SEC-AC-SMLC-M16-PB-SA
Weight	kg	1.49	1.58

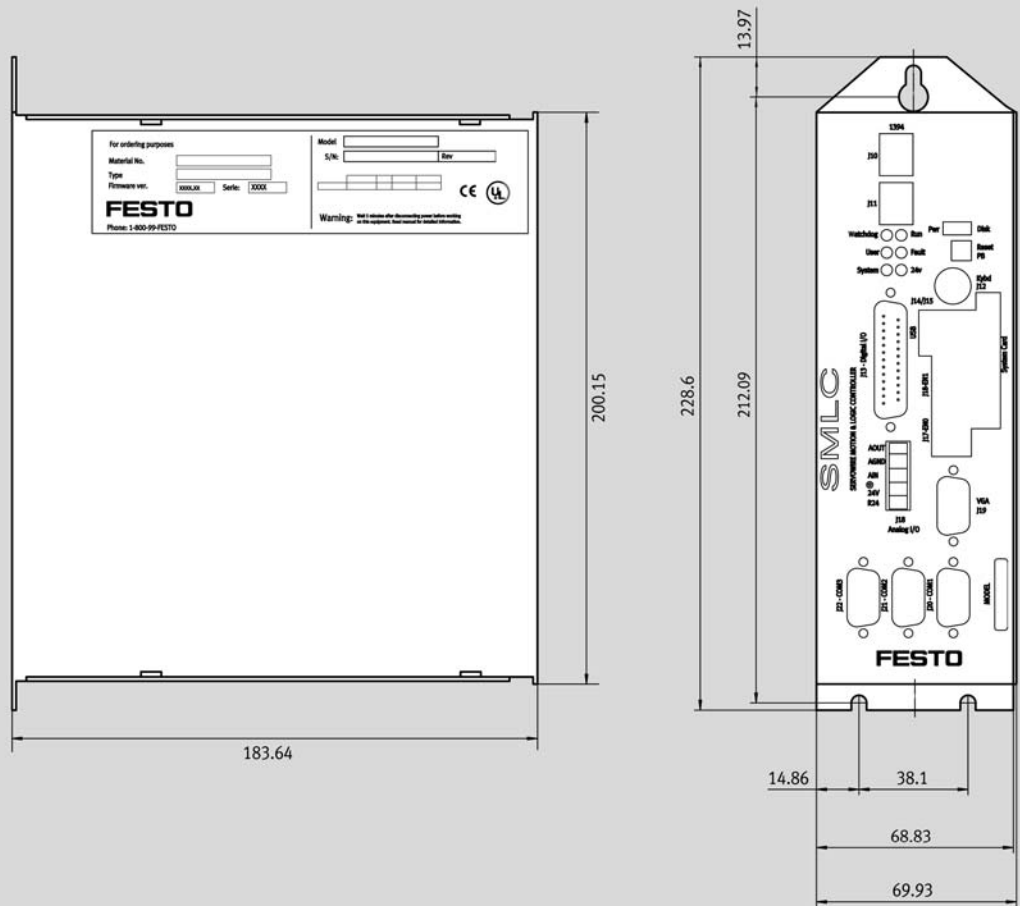
Technical Data – Dimensions

SEC-AC-SMLC Multi-Axis Controllers

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Multi-Axis Controllers (3-Axis and 8-Axis)

SEC-AC-SMLC-M3-SA, SEC-AC-SMLC-M8-SA



All dimensions are shown in millimeters [mm]

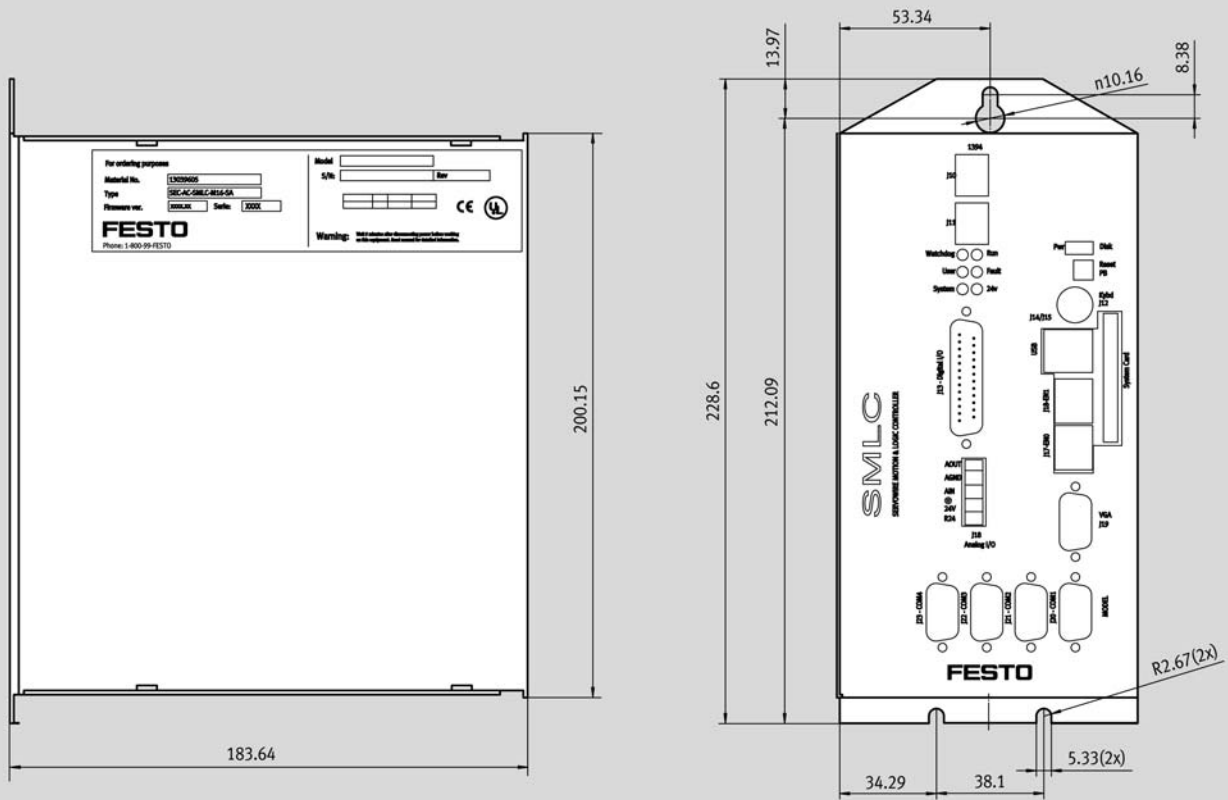
Technical Data – Dimensions

SEC-AC-SMLC Multi-Axis Controllers

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Multi-Axis Controllers (16-Axis)

SEC-AC-SMLC-M16-SA



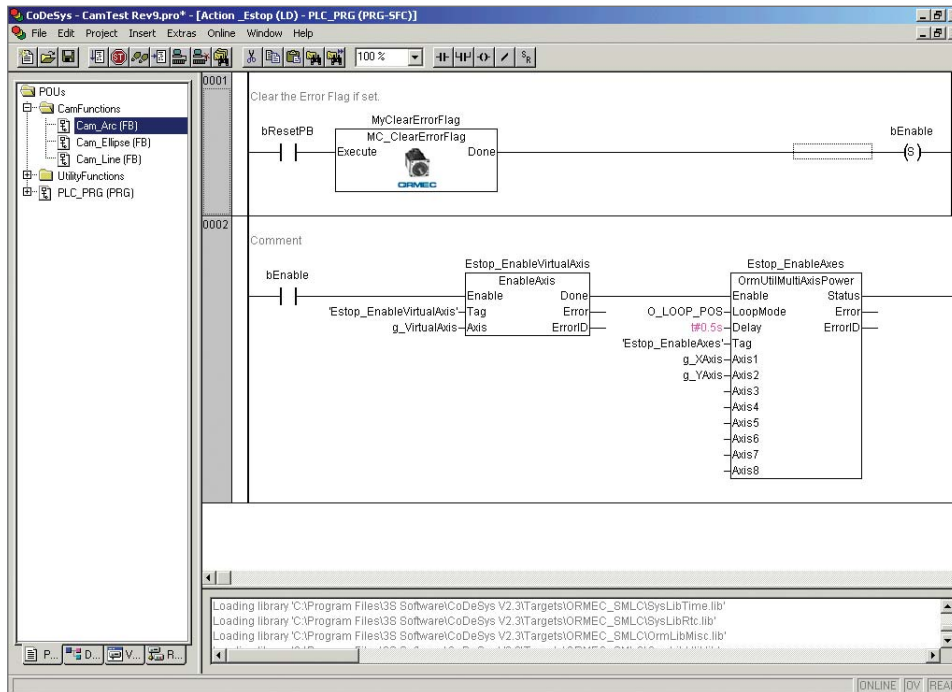
CoDeSys Development Software

Developing Motion control and I/O programming using a standard set of software tools streamlines software development and creates

application programs that are more effective and easier to support in the field.

The CoDeSys development software utilizes standard IEC 61131-3 programming and PLCopen motion function blocks to provide proven,

open standard tools for developing application programs for motion control and I/O control running on a single controller.



CoDeSys Development Tools

Program motion control and logic using standard IEC61131-3 tools. The suite of programming languages and charting tool simplifies machine development and support. Select among graphical and text-based languages – Relay Ladder Logic, Function Block Diagram, Structured Text, Instruction List, Sequential Function Chart or Continuous Function Chart. The CoDeSys development environment provides tools for creating visualizations which can be used to build operator entry and diagnostic displays useful for testing and debugging the application.

PLCopen Motion Control Library

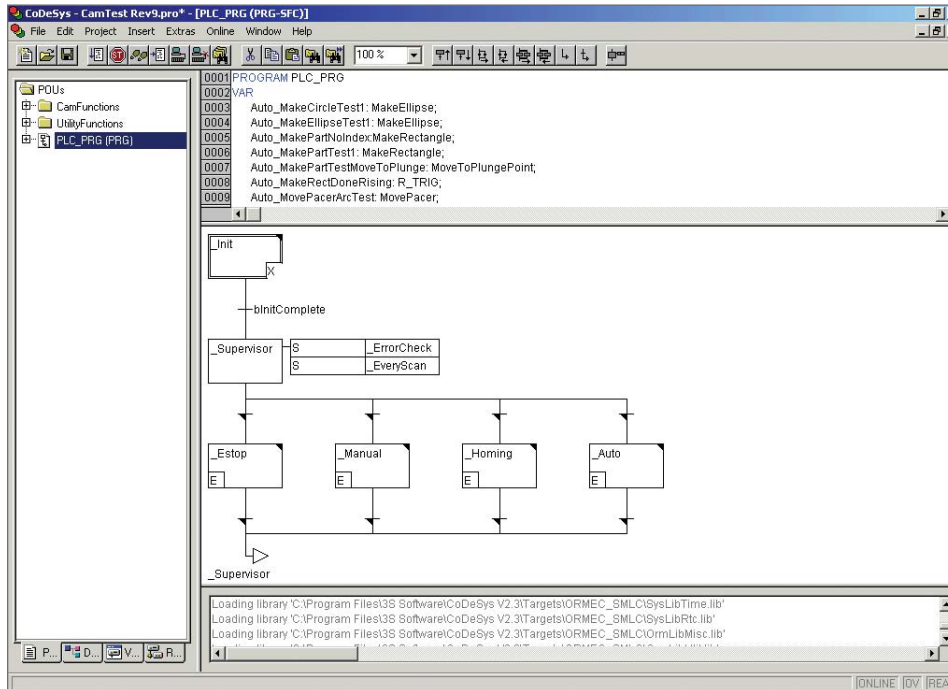
PLCopen (an independent worldwide association) has defined a standard library of motion programming function blocks which cover all the IEC 61131-3 programming languages. Function blocks cover both motion and administrative functions like ReadParameter, ReadActualPosition, PositionProfile, CamIn, CamOut.

ORMEC Motion Control Extensions

ORMEC's motion programming implementation (ServoWire Motion Blocks) conforms to the PLCopen motion block definitions and provides powerful, flexible functionality beyond that defined in the standard. Using the ServoWire Motion blocks, a variety of applications can be written in any of the IEC 61131-3 programming languages. Function blocks cover both motion and administrative functions like blocks handling enhanced diagnostic capabilities, Move Absolute in Time, Move Relative at Velocity.

CoDeSys Development Software

The PLCopen standard Motion Control Library, plus powerful ORMEC extensions, bring new levels of motion camming, registration control and performance for electronic gearing, coordinated, multi-axis applications.



Built-in Networking Support

Standard networking solutions and support for Ethernet TCP/IP, Modbus/TCP, Profibus DP and OPC Server provide connectivity to factory data networks, supporting connectivity for motion and I/O control and HMI devices (which support Modbus TCP or Modbus RTU).

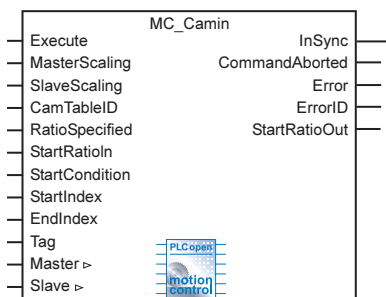
Reduced Learning and Engineering time

Reduce training costs by learning one set of programming languages used by multiple control vendors. Provide flexibility for selecting the best programming approach and method for the specific application tasks and requirements. In addition, the programmer is able to develop and deploy reusable function blocks which can reduce future software development costs.

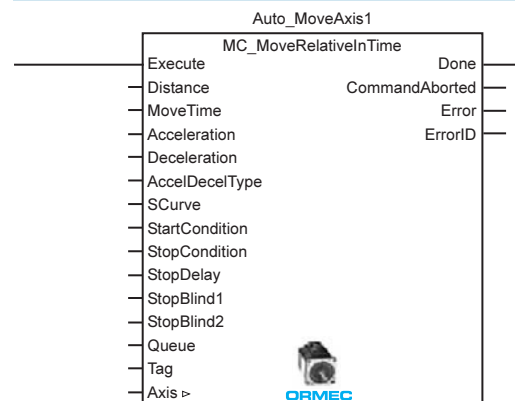
Highly Structured Programming

Application programs can be written as a state machine in Sequential Function Chart (SFC). SFC provides a graphical flow charting tool that illustrates the program flow and structure of the user's application program. SFC makes it easier to view a multi-layered, graphical model of the program and provides excellent tools for application development and maintenance.

PLCopen Function Block



Enhanced Function Block



Ordering Data

SEC-AC-SMLC Multi-Axis Controllers

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Order Code Example



Festo multi-axis controllers are ordered with an order code.

The order code consists of the part number and type as shown below.

Part No. **Type**
13040199 **SEC-AC-SMLC - M16 - PB - SA**

Controller model Maximum number of axes With Profibus master Standard SA product

Examples:

8-Axis controller without Profibus master

– Order: 13039604 SEC-AC-SMLC-M8-SA

3-Axis controller with Profibus master

– Order: 13040197 SEC-AC-SMLC-M3-PB-SA

Cable from controller to drive, bilingual (2 meter length)

– Order: 13039613 KSDD-CLR-SW2-SA

Controllers				
Description	Axis Configuration	Voltage	Part No.	Type
SMLC Model M3	3-axis	115/230 VAC	13039603	SEC-AC-SMLC-M3-SA
SMLC Model M8	8-axis		13039604	SEC-AC-SMLC-M8-SA
SMLC Model M16	16-axis		13039605	SEC-AC-SMLC-M16-SA
SMLC Model M3	3-axis with Profibus Master		13040197	SEC-AC-SMLC-M3-PB-SA
SMLC Model M8	8-axis with Profibus Master		13040198	SEC-AC-SMLC-M8-PB-SA
SMLC Model M16	16-axis with Profibus Master		13040199	SEC-AC-SMLC-M16-PB-SA

Controller Cable				
Description	Cable Length	Connection	Part No.	Type
ServoWire Cable, Bilingual	1m	Cable from controller to drive	13039612	KSDD-CLR-SW1-SA
ServoWire Cable, Bilingual	2m		13039613	KSDD-CLR-SW2-SA

Accessories				
Description	Cable Length	Part No.	Type	
Digital I/O Cable for SEC-AC-SMLC	1 m	13039971	KDIO-SMLC-1-SA	
Digital I/O Cable for SEC-AC-SMLC	3 m	13039972	KDIO-SMLC-3-SA	
Digital I/O Cable for SEC-AC-SMLC	5 m	13039973	KDIO-SMLC-5-SA	
Digital I/O Cable for SEC-AC-SMLC	X m (adder/meter)	13039974	KDIO-SMLC-X-SA	
Phoenix Extension Block (25 pin)	–	13039975	KPHX-CON-SMLC-SA	
Flash Memory Card for SMLC Controller (128 MB)	–	13039976	MEM-SMLC-SA	
Analog Connector for SEC-AC-SMLC	–	13039977	AIO-CONN-SMLC-SA	
Power Connector for SEC-AC-SMLC	–	13039994	PWR-CONN-SMLC-SA	

Documentation and Software		
Description	Part No.	Type
CoDeSys Software Development Kit, CDROM with 1 yr Maintenance/Support ¹⁾	13039641	P.SW-CDK-SA
CD Documentation – Controller, Drives and Motors (Installation and Commissioning Manuals)	13039937	P.BE-SEC-AC-SMLC/SDD-SA
SEC-AC-SMLC Controllers – Installation and Commissioning Manual	13039938	P.BE-SEC-AC-SMLC-SA

¹⁾ CD-ROM includes ServoWire Pro (drive parameterization software) and installation and commissioning manuals for SEC-AC-SMLC controllers and SEC-SDD drives.
Maintenance contract can be renewed at a nominal charge.

All SEC-AC-SMLC controllers are supplied with:

- Analog I/O connector
- Power Connector
- Flash Memory

Documentation

Manuals in PDF format are available for download at:
www.festo.com/us/m&c/smlc.



SEC-SDD ServoWire Drives

Four models available
with two variants each

- 2A drive with integrated resolver feedback module
- 4A drive with integrated resolver feedback module
- 8A drive with integrated resolver feedback module
- 14A drive with integrated resolver feedback module

Variant with encoder feedback
for all four models is available

Technical Data – Electrical

SEC-SDD ServoWire® Digital Drives

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Drive Power / Output Current:

- Range: 290 W to 3.3 kW
- Range: 2.5 A rms to 13.9 A rms

Integrated I/O:

- Digital inputs (3+1)
- Digital outputs (4+1)
- High-speed sensor inputs

Operating Voltages:

- Single-phase (115 VAC, 230 VAC)
- Three-phase (230 VAC)

Feedback Options (With Open Wire Detection):

- Resolver with software configurable resolution
- Incremental encoder interface

Drive Network:

- High bandwidth synchronous, all digital servo drive network based on IEEE 1394 (2 ports)



General Electrical Specifications		2 A	4 A	8 A	14 A
Type	Resolver Variant	SEC-SDDR2/4-SA	SEC-SDDR4/7-SA	SEC-SDDR8/14-SA	SEC-SDDR14/24-SA
	Encoder Variant	SEC-SDDE2/4-SA	SEC-SDDE4/7-SA	SEC-SDDE8/14-SA	SEC-SDDE14/24-SA
Incoming main power line voltage		Single phase, 50/60 Hz 115 (+15%, -20%) or 230 (+15%, -20%) VAC		Single phase, 50/60 Hz 115 (+15%, -20%) or 230 (+15%, -20%) VAC Three phase, 50/60 Hz 230 (+15%, -20%) VAC 20 W typical (45 W maximum)	
Incoming control power line voltage		Single phase, 50/60 Hz; 115 (-20%) to 230 (+15%) VAC [auto adjusting]			
Main DC bus vltage		115 VAC nominal input power: 163 VDC nominal level 230 VAC nominal input power: 325 VDC nominal level			
Shunt regulator activation DC bus voltage		115 VAC motors: 207 VDC 230 VAC motors: 395 VDC			
High bus voltage fault activation DC bus voltage		115 VAC motors: 237 VDC 230 VAC motors: 425 VDC			
Low bus voltage fault activation DC bus voltage		115 VAC motors: 94 VDC 230 VAC motors: 205 VDC			

Output Specifications		2 A	4 A	8 A	14 A
Type	Resolver Variant	SEC-SDDR2/4-SA	SEC-SDDR4/7-SA	SEC-SDDR8/14-SA	SEC-SDDR14/24-SA
	Encoder Variant	SEC-SDDE2/4-SA	SEC-SDDE4/7-SA	SEC-SDDE8/14-SA	SEC-SDDE14/24-SA
Single-phase 115 VAC Input					
Rated output power	KVA	0.29	0.49	0.58	0.98
Continuous current	Amps RMS / Ø	2.5	4.2	5.1	8.6
Peak current, 2 sec.	Amps RMS / Ø	4.4	7.4	8.8	14.8
Single-phase 230VAC Input					
Rated output power	KVA	0.59	0.98	1.17	1.97
Continuous current	Amps RMS / Ø	2.5	4.1	4.9	8.2
Peak current, 2 sec.	Amps RMS / Ø	4.2	7.1	8.5	14.3
Three-phase 230 VAC Input					
Rated output power	KVA	N/A	N/A	1.95	3.32
Continuous current	Amps RMS / Ø	N/A	N/A	8.2	13.9
Peak current, 2 sec.	Amps RMS / Ø	N/A	N/A	14.2	24.1

I/O Specifications	
All Models	
I/O Power Supply (V+S and V-S)	
Externally supplied voltage	For high speed sensor inputs, digital inputs, and digital outputs
Max voltage between V+S and V-S	+27 VDC maximum
High-speed Sensor Inputs	
Input current depends on software configuration	
NPN type sensor	– 8.9 mA at 24 VDC (with 2.7 kΩ pull-up resistor selected in drive)
PNP type sensor	– Current depends on pull-down resistance in sensor (or external pull down)
Maximum voltage	V+S
Minimum acceptance time	1 μs
Turn on voltage	Receiver output:
$V_{IN} > 0.5 \times (V+S) + 0.4$ VDC	– high
$V_{IN} < 0.5 \times (V+S) + 0.1$ VDC	– low
Digital Inputs, 4 [1 Input: bidirectional ¹⁾], Optically Coupled	
Current (switch on)	0.7 mA minimum 7.0 mA maximum
Voltage maximum	5V + V+S maximum
Digital Outputs, 5 [1 Output: bidirectional ²⁾], Optically Coupled	
Maximum sink current	33 mA
Low level voltage	0.7 VDC maximum (Ic = 33 mA)
High level voltage	V+S – 0.5 VDC
Absolute maximum	27 VDC

1) Sensor/switch should sink current to prevent an over travel limit condition (NPN or switch).

2) Bidirectional pin shared.

Certification	
	c UL us - Listed
	89/336/EEC (EMC) 73/23/ECC (low voltage)

Performance Specifications		2 A	4 A	8 A	14 A
Type	Resolver Variant	SEC-SDDR2/4-SA	SEC-SDDR4/7-SA	SEC-SDDR8/14-SA	SEC-SDDR14/24-SA
	Encoder Variant	SEC-SDDE2/4-SA	SEC-SDDE4/7-SA	SEC-SDDE8/14-SA	SEC-SDDE14/24-SA
PWM frequency		20 kHz			10 kHz
Torque loop		10 kHz			
Position loop		500 Hz to 2 kHz			
Velocity loop		2.5 kHz			

Weights		2 A	4 A	8 A	14 A
Type	Resolver Variant	SEC-SDDR2/4-SA	SEC-SDDR4/7-SA	SEC-SDDR8/14-SA	SEC-SDDR14/24-SA
		2.0 kg			2.7 kg
Type	Encoder Variant	SEC-SDDE2/4-SA	SEC-SDDE4/7-SA	SEC-SDDE8/14-SA	SEC-SDDE14/24-SA
		1.9 kg			2.6 kg

Motor Feedback Specifications	
Motor Encoder Interface	
Channels A and B – Differential Digital Inputs	
Common mode input	–15 VDC to +15 VDC maximum
Absolute maximum input voltage	± 25 VDC
Maximum encoder counts per rev	1,000,000 (after 4x decode)
Maximum encoder data rate	4 MHz
Quadrature specification	90°, ± 45°
Differential turn on voltage: $V_{ID} > 0.7 \text{ V}$ $-0.7 \text{ V} > V_{ID} > 0.7 \text{ V}$ $V_{ID} < -0.7 \text{ V}$	Receiver output: – H – Not defined – L
Channel Z (Index Pulse) – Differential and Single-ended Digital Input	
Common mode input	–12 VDC to +12 VDC maximum
Absolute maximum input voltage	± 25 VDC
Differential turn on voltage $V_{ID} > 0.2 \text{ V}$ $-0.2 \text{ V} > V_{ID} > 0.2 \text{ V}$ $V_{ID} < -0.2 \text{ V}$	Receiver output: – H – Not defined – L
Single-ended turn on voltage $V_{IS} > 3 \text{ V}$ $2 \text{ V} > V_{IS} > 3 \text{ V}$ $V_{IS} < 2 \text{ V}$	Receiver output: – H – Not defined – L
Encoder Power Supply	
5.3 VDC, ± 5%; 450 mA maximum	
Encoder Connection	
25-pin female	
Over-temperature Sensing – Optically Isolated Digital Input ¹⁾	
Current to turn on	2.5 mA
Maximum voltage	+12 VDC maximum

Motor Feedback Specifications	
Resolver Interface	
Feedback resolution (software configurable)	65,536 cnt/rev @ 16-bit / 16,384 cnt/rev @ 14-bit / 4,096 cnt/rev @ 12-bit
Maximum motor speed	1,500 rpm @ 16-bit / 6,000 rpm @ 14-bit / 24,000 rpm @ 12-bit
Resolver type	Single speed
Transformation ratio	0.5
Excitation – Differential Digital Output	
Excitation amplitude	0 to 8 V RMS / 4 V RMS at 100% (default) in ServoWire Pro
Excitation frequency	2.5, 5 to 10 kHz, software configurable
Feedback Signal (Sine/Cosine) – Differential Digital Inputs	
Feedback amplitude	2 V RMS, ± 15%
Resolver Connection	
25-pin male	
Over-temperature Sensing – Optically Isolated Digital Input ¹⁾	
Current to turn on	2.5 mA
Maximum Voltage	+12 VDC maximum

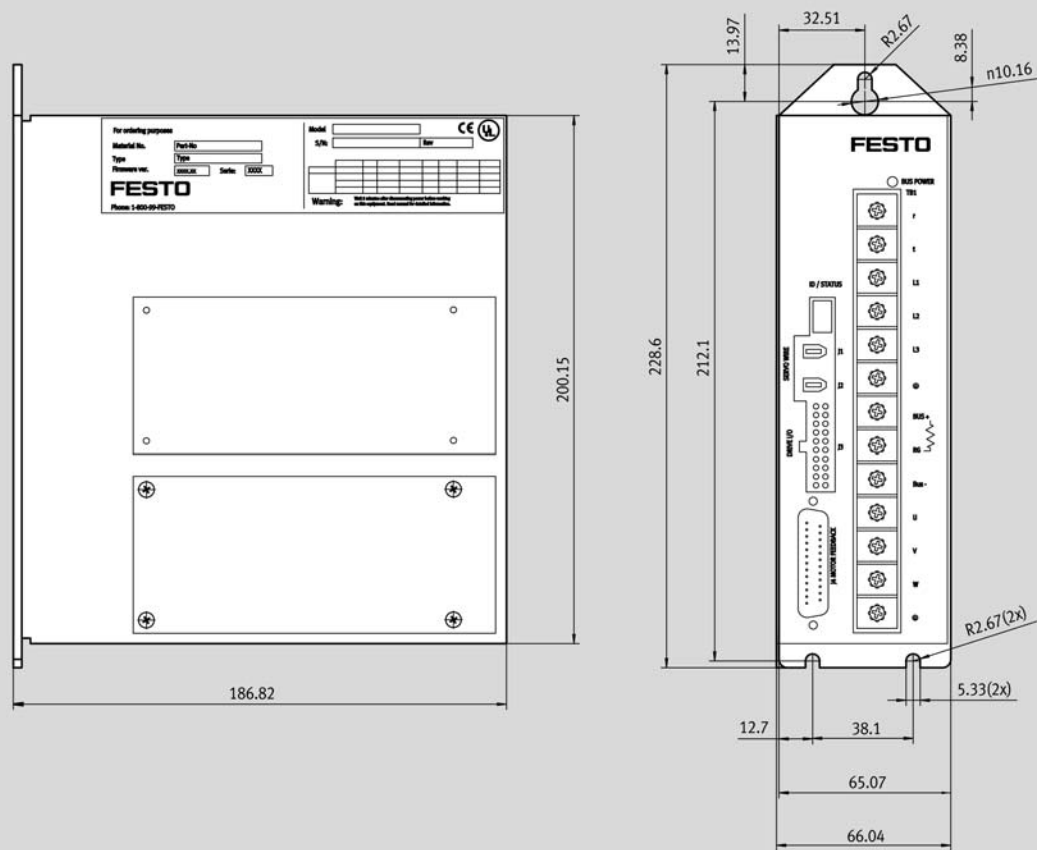
1) Should be normally sinking current to prevent an over-temperature condition.

Operating and Environmental Conditions	
All Models	
Operating temperature	0 to 50 °C / 32 to 122 °F
Storage temperature	–20 to 70 °C / –13 to 158 °F
Operating and storage humidity	10% to 90%, non condensing

SEC-SDD ServoWire® Digital Drives

ServoWire Drives with Encoder Feedback (2 A, 4 A and 8 A)

SEC-SDDE-2/4-SA, SEC-SDDE-4/7-SA, SEC-SDDE-8/14-SA



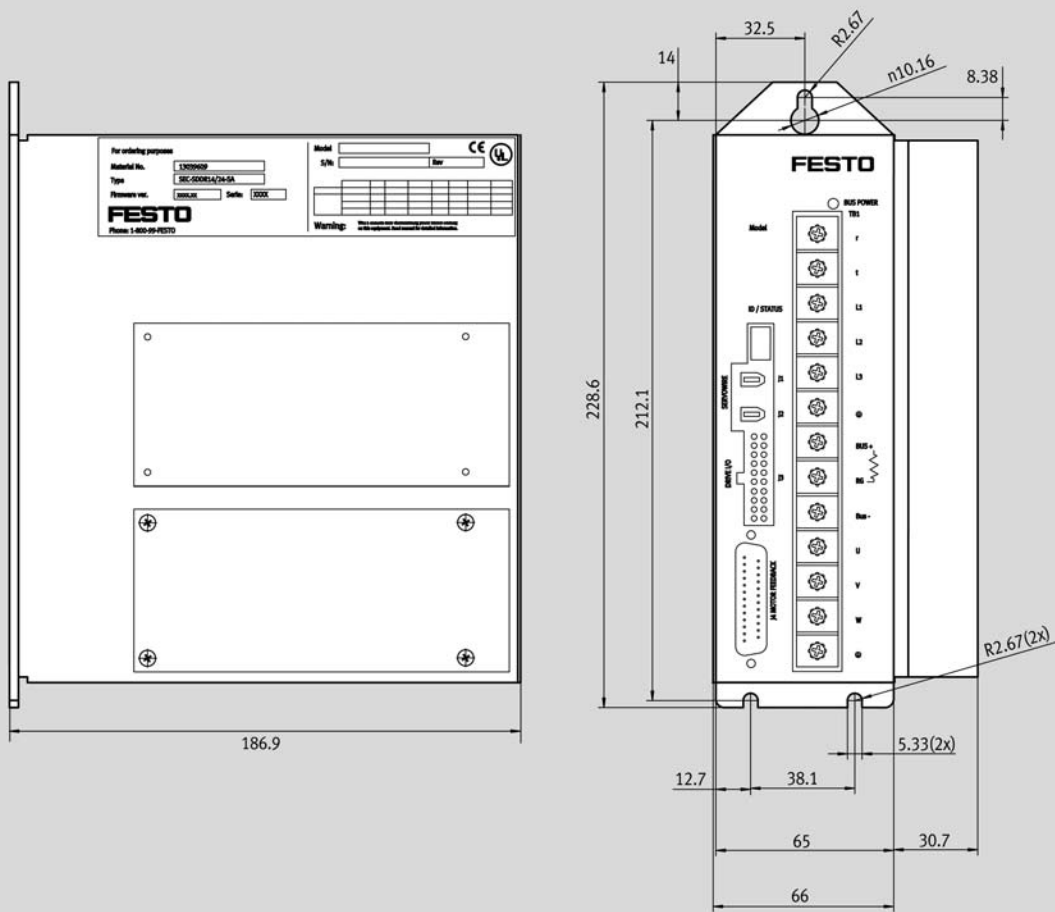
All dimensions are shown in millimeters [mm]

Technical Data – Dimensions

SEC-SDD ServoWire® Digital Drives



ServoWire Drives with Encoder Feedback (14 A) SEC-SDDE-14/24-SA



All dimensions are shown in millimeters [mm]

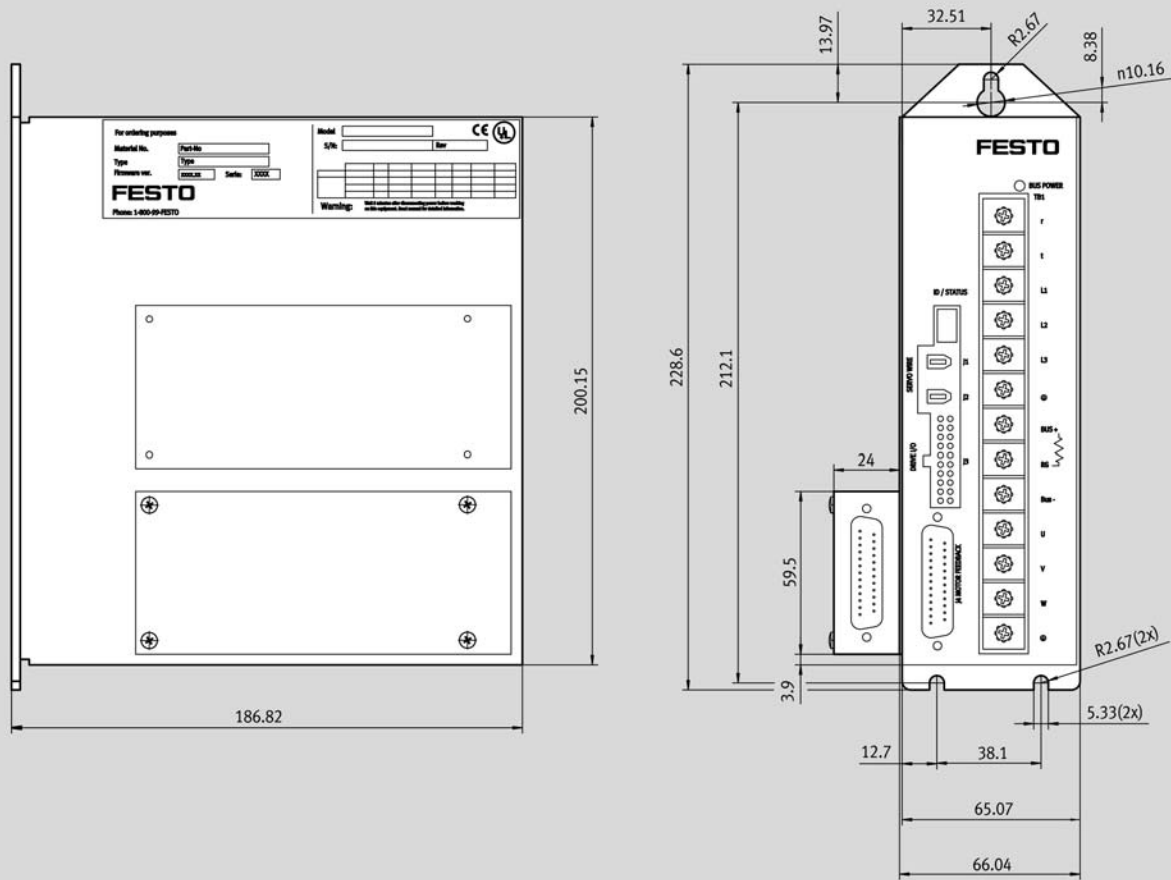
Technical Data – Dimensions

SEC-SDD ServoWire® Digital Drives

FESTO

ServoWire Drives with Resolver Feedback (2 A, 4 A and 8 A)

SEC-SDDR-2/4-SA, SEC-SDDR-4/7-SA, SEC-SDDR-8/14-SA



All dimensions are shown in millimeters [mm]

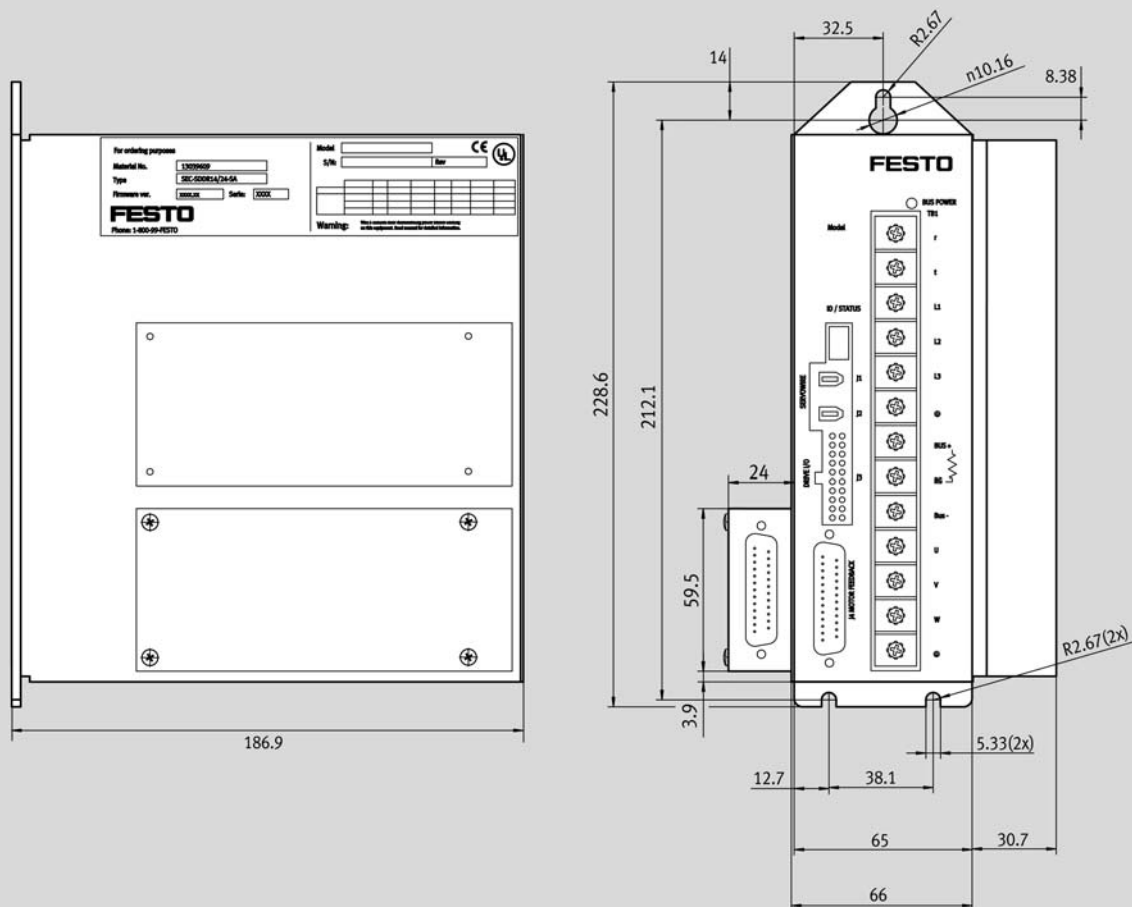
Technical Data – Dimensions

SEC-SDD ServoWire® Digital Drives



ServoWire Drives with Resolver Feedback (14 A)

SEC-SDDR-14/24-SA



All dimensions are shown in millimeters [mm]

ServoWire Pro Software

ServoWire Pro provides an integrated suite of configuration, diagnostic and maintenance utilities that assist in the development and ongoing support of SEC-SDD ServoWire digital drive systems.

ServoWire Setup provides menus and software wizards to simplify the configuration of SEC-SDD ServoWire digital drives.

ServoWire Upgrade provides tools for upgrading the SEC-SDD drives to latest firmware.

ServoWire Tune includes tuning scope and software for optimizing motion performance.

ServoWire Monitor provides diagnostic utilities for monitoring drive and network performance.

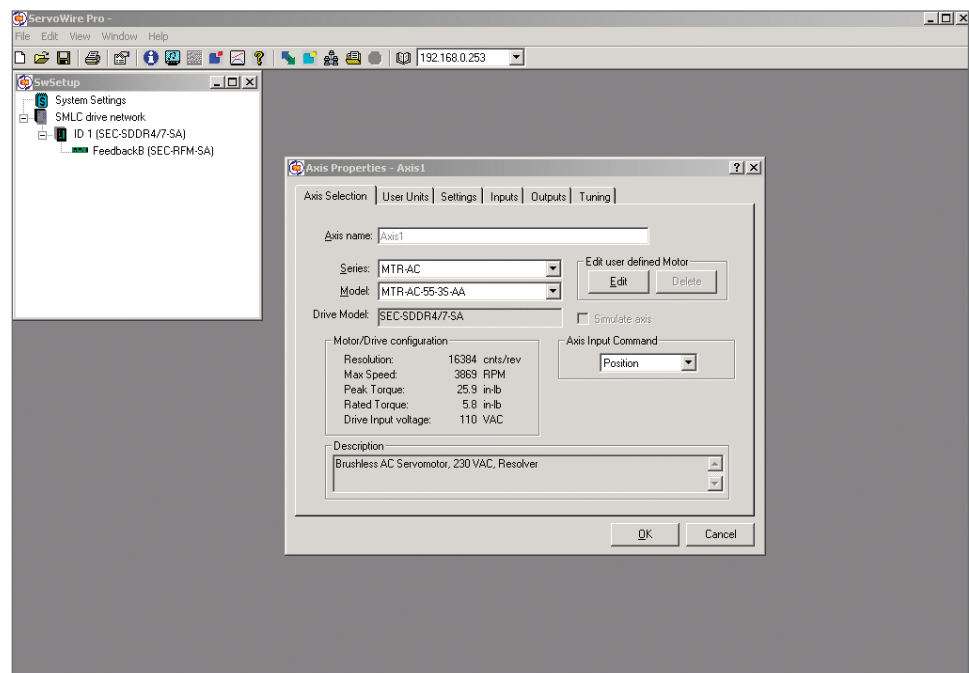
ServoWire Cam Profile Designer aids users in creating cam and profile data.

ServoWire Setup

ServoWire setup simplifies the process of configuring SEC-SDD ServoWire digital drives. This includes system settings such as loop update rates, the types of drives that make up the system as well as initial parameter settings.

Setup Utility Features:

- Configure system parameters such as loop update rate and drive models.
- Add, remove, copy, and paste up to 16 drives onto the ServoWire network.
- Add motors to the ServoWire drives by selecting from a user defined library of custom motors.
- Configure each drive's operating voltage, local I/O and external regen resistor (optional).
- Configure axis position, velocity and acceleration units and establish the maximum range limits.
- Configure axis response to drives' high-speed discrete inputs (rising-edge, falling-edge or level).
- Configure axis output for brake control.
- Establish initial axis tuning parameters for position, velocity and current control loops.



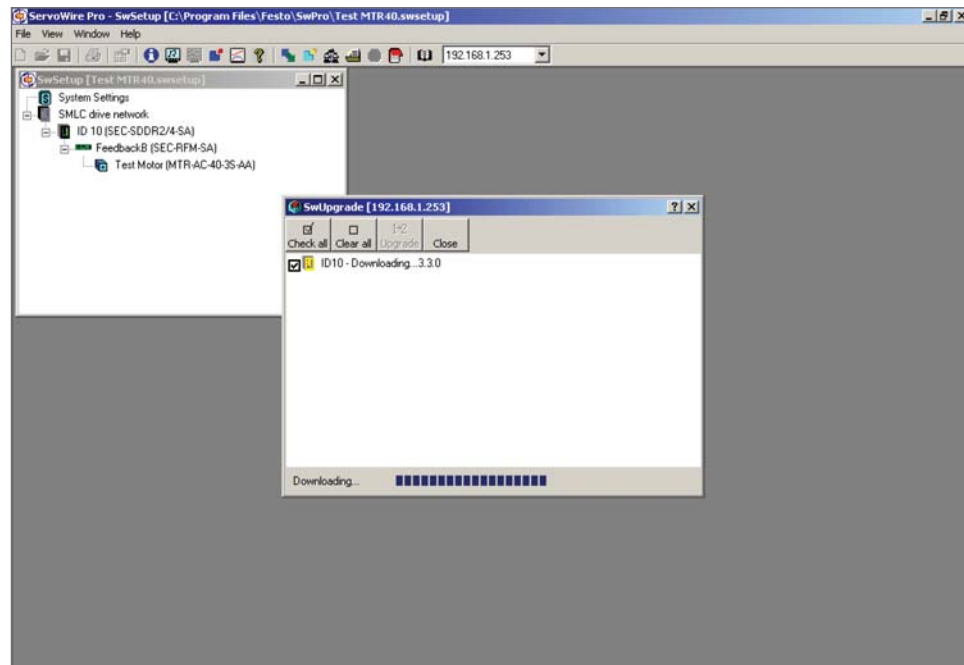
ServoWire Pro Software

ServoWire Upgrade

The ServoWire upgrade utility provides the user with the means to update SEC-SDD ServoWire digital drives with new firmware versions as they become available.

Upgrade Utility Features:

- Display current version of firmware of all connected ServoWire drives.
- Allow for download of a different firmware version (older or newer), which is burned into the drives' Flash memory.

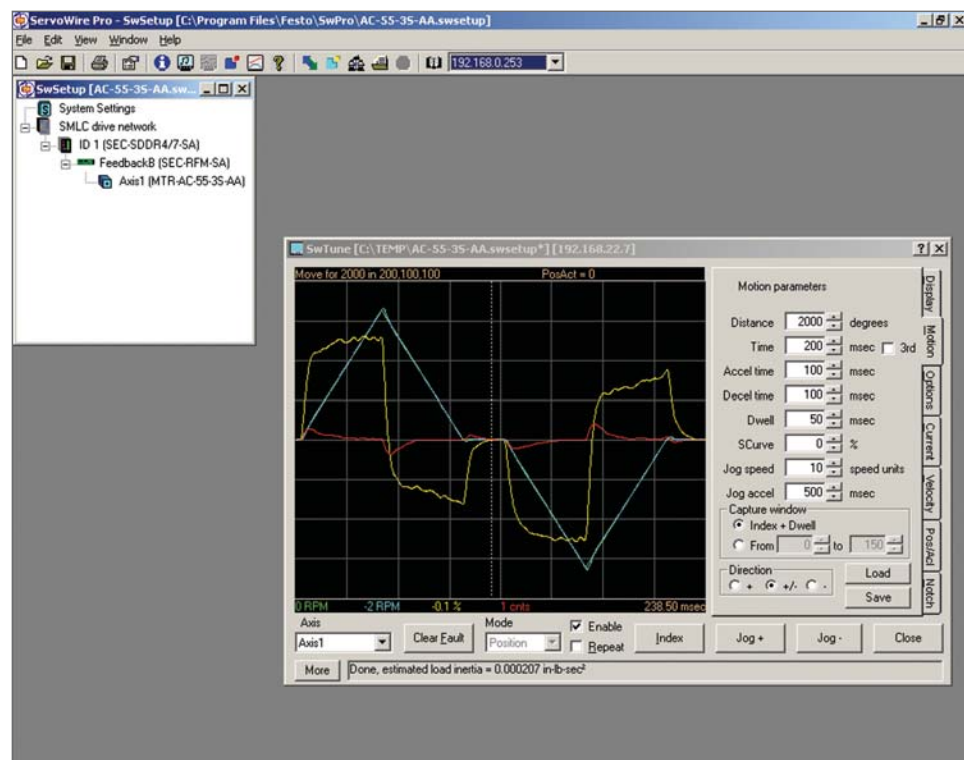


ServoWire Tune

ServoWire tune provides users software utilities for optimizing motion performance, and documenting tuning parameters for future reference. ServoWire tune allows modification of the control system parameters to provide the proper response to motion profiles specific to your application with a real-time display of position error, velocity command, actual velocity and torque response.

Tuning Utility Features:

- Perform user-specified motion on a ServoWire axis and graphically display up to 4 performance parameters.
- Change tuning parameters for position, velocity and current loops and immediately observe the effects on system performance.
- Graph data including velocity, torque, position error, drive bus voltage, and motor phase currents. Zoom-pan views allow for precise and thorough examination of the data.
- User-friendly interface with the ability to save motion and graphing setups. The user can also save and retrieve displayed graphical data for viewing or printing.



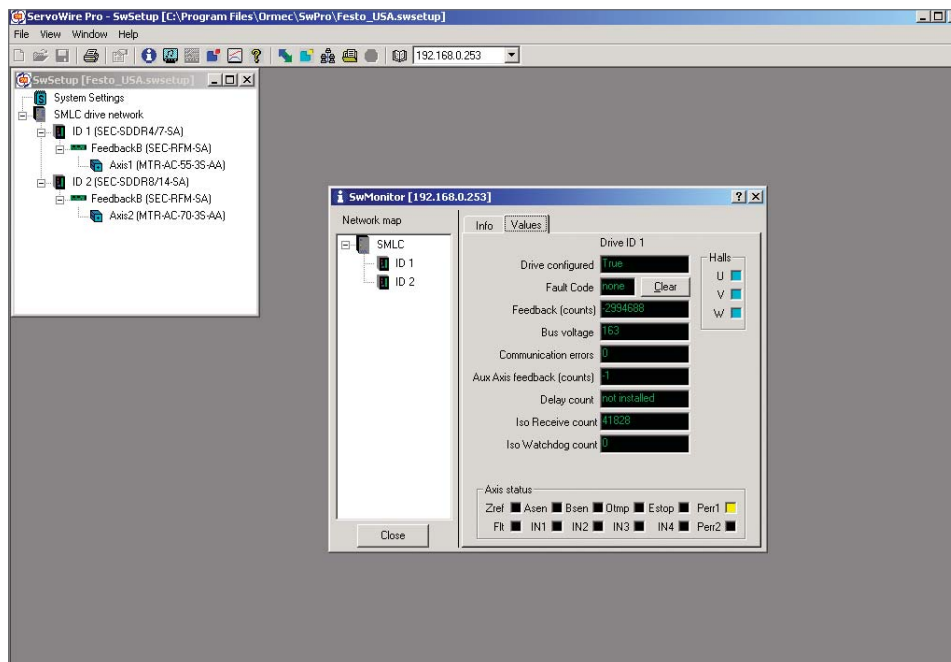
ServoWire Pro Software

ServoWire Monitor

The ServoWire monitor provides an effective way to view devices on a ServoWire network. This includes the SEC-AC-SMLC controller, all drives and other devices on the 1394 network.

Monitor Utility Features:

- Display drive model and serial numbers, firmware revisions, hardware revisions and modifications.
- Provide real-time drive performance information. Data is presented for: drive DC bus, drive fault data, Hall center status, drive I/O, network performance, and more.
- Monitor system data while user application program is running.

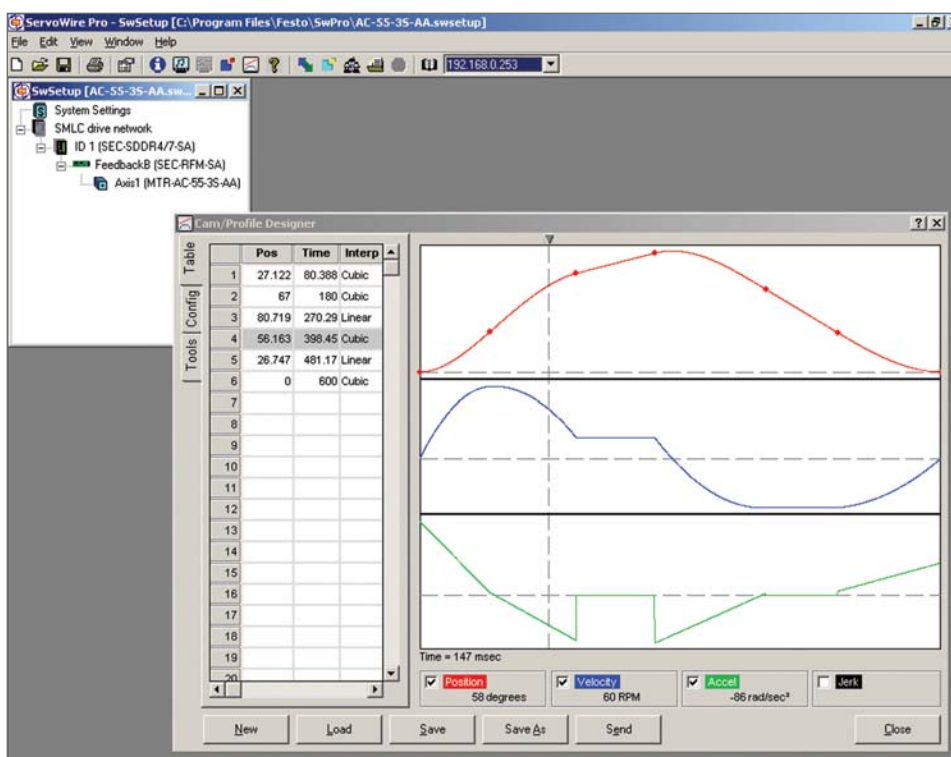


ServoWire Cam Profile Designer

ServoWire Cam/Profile Designer aids users in creating cam (master position vs. follower position) and profile (axis position vs. time) data. Users can enter the data directly into the Cam/Profile Designer, or they can import data from a file.

Cam/Profile Designer Utility Features:

- View commanded position, velocity, acceleration, and jerk data for the specified motion.
- Set the type of interpolation used on a segment-by-segment basis.



Ordering Data

SEC-SDD ServoWire® Digital Drives

FESTO

Order Code Example



Festo ServoWire digital drives are ordered with an order code.

The order code consists of the part number and type as shown below.

Part No. **Type**
13040213 **SEC - SDDE14/24 - SA**

Drive model RMS/peak current (A) Standard SA product

Servo digital drive With encoder feedback interface

Examples:

ServoWire digital drive, 4.1/7.1A RMS/peak, with resolver

– Order: 13039607 SEC-SDDR4/7-SA

ServoWire digital drive, 14/24A RMS/peak, with encoder

– Order: 13040213 SEC-SDDE14/24-SA

Cable from drive to drive, bilingual (2 meter length)

– Order: 13039610 KSDD-SDD-SW2-SA

Drives				
Description	Variant	Voltage	Part No.	Type
ServoWire Digital Drives, 2.4/4.1A rms/ pk.	Resolver variant	115-230 VAC	13039606	SEC-SDDR2/4-SA
ServoWire Digital Drives, 4.1/7.1A rms/ pk.			13039607	SEC-SDDR4/7-SA
ServoWire Digital Drives, 8.2/14A rms/ pk.			13039608	SEC-SDDR8/14-SA
ServoWire Digital Drives, 14/24A rms/ pk.			13039609	SEC-SDDR14/24-SA
ServoWire Digital Drives, 2.4/4.1A rms/ pk.	Encoder variant		13040210	SEC-SDDE2/4-SA
ServoWire Digital Drives, 4.1/7.1A rms/ pk.			13040211	SEC-SDDE4/7-SA
ServoWire Digital Drives, 8.2/14A rms/ pk.			13040212	SEC-SDDE8/14-SA
ServoWire Digital Drives, 14/24A rms/ pk.			13040213	SEC-SDDE14/24-SA

Drive Cables				
Description	Cable length	Connection	Part No.	Type
ServoWire Cable	1 m	Cable from drive to drive	13039610	KSDD-SDD-SW1-SA
ServoWire Cable	2 m		13039611	KSDD-SDD-SW2-SA
ServoWire Cable, Bilingual	1 m	Cable from controller to drive	13039612	KSDD-CLR-SW1-SA
ServoWire Cable, Bilingual	2 m		13039613	KSDD-CLR-SW2-SA
Standard Resolver Cable	1 m	Cable from drive to motor (MTR-AC)	13039615	KRES-AC-S-1-SA
Standard Resolver Cable	3 m		13039616	KRES-AC-S-3-SA
Standard Resolver Cable	5 m		13039617	KRES-AC-S-5-SA
Standard Resolver Cable	X m (adder/meter)		13039618	KRES-AC-S-X-SA
Hi Flex Resolver Cable	1 m		13039619	KRES-AC-F-1-SA
Hi Flex Resolver Cable	3 m		13039620	KRES-AC-F-3-SA
Hi Flex Resolver Cable	5 m		13039621	KRES-AC-F-5-SA
Hi Flex Resolver Cable	X m (adder/meter)		13039622	KRES-AC-F-X-SA
Standard Power Cable	1 m		13039623	KMTR-AC-S-1-SA
Standard Power Cable	3 m		13039624	KMTR-AC-S-3-SA
Standard Power Cable	5 m		13039625	KMTR-AC-S-5-SA
Standard Power Cable	X m (adder/meter)		13039626	KMTR-AC-S-X-SA
Hi Flex Power Cable	1 m		13039627	KMTR-AC-F-1-SA
Hi Flex Power Cable	3 m		13039628	KMTR-AC-F-3-SA
Hi Flex Power Cable	5 m		13039629	KMTR-AC-F-5-SA
Hi Flex Power Cable	X m (adder/meter)		13039640	KMTR-AC-F-X-SA
Standard Cable Set	1 m		13040214	KSEC-AC-S-1-SA
Standard Cable Set	3 m		13040215	KSEC-AC-S-3-SA
Standard Cable Set	5 m		13040216	KSEC-AC-S-5-SA
Hi Flex Cable Set	1 m		13040217	KSEC-AC-F-1-SA
Hi Flex Cable Set	3 m		13040218	KSEC-AC-F-3-SA
Hi Flex Cable Set	5 m		13040219	KSEC-AC-F-5-SA

Ordering Data

SEC-SDD ServoWire® Digital Drives

FESTO

Accessories		
Description	Part No.	Type
I/O Connector (Crimped) for SEC-SDD Drive	13040220	DIO-CONN-A-SDD-SA
I/O Connector (IDC) for SEC-SDD Drive	13040221	DIO-CONN-B-SDD-SA
I/O Connector with cable for SEC-SDD Drive	13049328	DIOK-CONN-A-SDD-SA
Resolver Feedback Module 14/16 bit, 6000 RPM max.	13039614	SEC-RFM-SA
Regen Resistors, 50 ohm, 55 W	13040223	SEC_SDD-RR-55
Regen Resistors, 40 ohm, 95 W	13040224	SEC_SDD-RR-95
Regen Resistors, 81 ohm, 230 W	13040225	SEC_SDD-RR-230
Regen Resistors, 72 ohm, 648 W	13040226	SEC_SDD-RR-650
Regen Resistors, 54 ohm, 700 W	13040227	SEC_SDD-RR-700
Regen Resistors, 40 ohm, 845 W	13040228	SEC_SDD-RR-845
Drive Line Filters, 15 A, Single-phase	13040229	SEC-SDD-LF15
Drive Line Filters, 30 A, Single-phase	13040230	SEC-SDD-LF30
Drive Line Filters, 30 A, Three-phase	13040231	SEC-SDD-LF30X
Brake Unit Kit (optically isolated relay with diode) for SEC-SDD Drive	13049327	SEC-SDD-BRK

Documentation and Software		
Description	Part No.	Type
ServoWire Pro Configuration Utility CD ¹⁾	13039970	P.SW.SWPRO-SA
Installation and Commissioning Manual SEC-SDD Drives	13039939	P.BE-SEC-SDD-SA

1) ServoWire Pro (drive parameterization software). Includes installation and commissioning manuals for SEC-SDD drives.

All SEC-SDD drives are supplied with:

- Drive I/O connector (13040220)

Documentation

Manuals in PDF format are available for download at:
www.festo.com/us/m&c/smlc.



Function Blocks

Motor and I/O
Compatibility

Festo Servo Motor
Performance Data

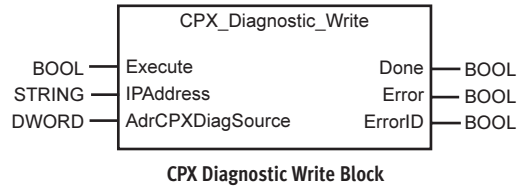
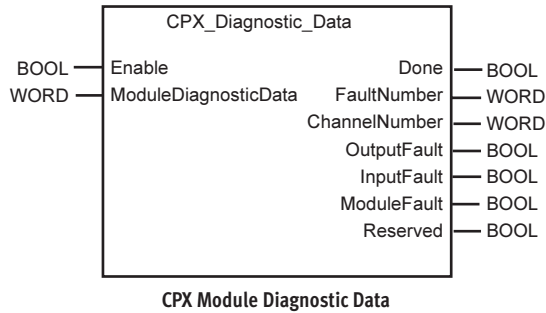
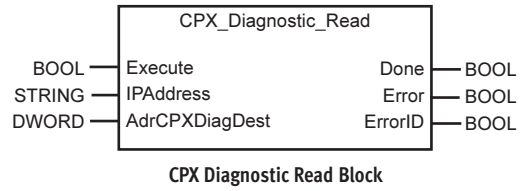
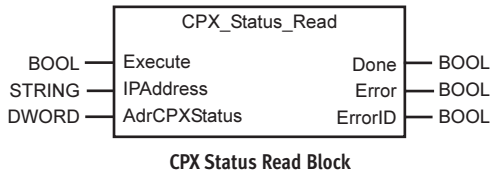
System Selection

Sensor Selection

Regen Resistor/Drive
Compatibility and Line
Filter Selection and Sizing

Glossary

CPX Function Blocks (For Communication Between CPX-FEC and SEC-AC-SMLC Controller via Modbus TCP)



ORMEC Specific Function Blocks (included as part of the CoDeSys development kit)

MC_AbsReset	MC_GearRelativeAtRatio	MC_ProfileTableLoad	MC_StopPublish
MC_AddToErrorLog	MC_GearRelativeInDist	MC_ProfileTableSelect	MC_Trigger
MC_CamCont	MC_MoveAbsoluteAtVelocity	MC_Publish	MC_UseLED
MC_CamRelative	MC_MoveAbsoluteInTime	MC_ReadAxisRef	MC_UtilityRead
MC_CamTableLoad	MC_MoveRelativeAtVelocity	MC_ReadErrorFlag	MC_UtilityWrite
MC_ClearErrorFlag	MC_MoveRelativeInTime	MC_ReadErrorLog	MC_WriteRealParameter
MC_Close	MC_Open	MC_ReadRealParameter	
MC_DelayCounter	MC_ProfileRelative	MC_SetPos ActFromPosAbs	

Supported PLCopen Function Blocks

Administrative		Motion	
Single Axis	Multiple Axis	Single Axis	Multiple Axis
MC_Power	MC_DigitalCamSwitch	MC_MoveAbsolute	MC_CamIn
MC_ReadStatus		MC_MoveRelative	MC_CamOut
MC_ReadAxisError		MC_MoveVelocity	MC_GearIn
MC_Read Parameter		MC_Home	MC_GearOut
MC_ReadBoolParameter		MC_Stop	
MC_Write Parameter		MC_PositionProfile	
MC_WriteBoolParameter			
MC_ReadActualPosition			
MC_Reset			

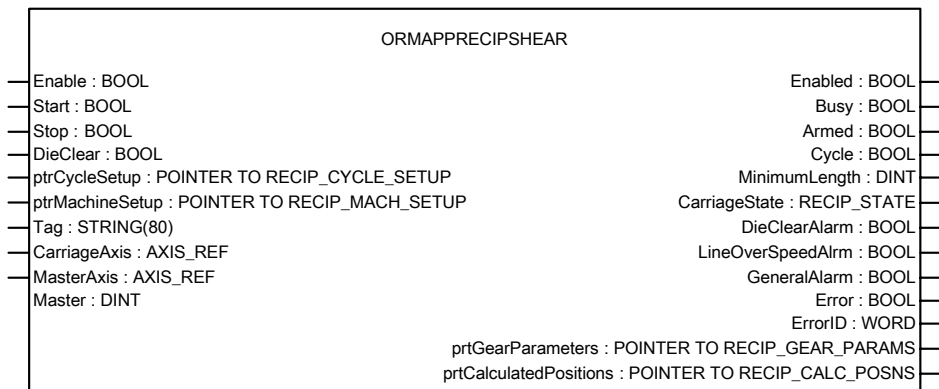
Supported PLCopen 2 Function Blocks

Multiple Axis

MC_CamTableSelect

Reciprocating Flying Shear Application Function Block

This function block makes it easy to implement a full-featured Reciprocating Flying Shear application with a minimum of programming. Reciprocating Flying Shears are used to cut, emboss, print or apply other processes to a moving web. The carriage axis, which carries the knife or die, accelerates to match the web speed. The knife or die then cycles to perform the process while the carriage is synchronized to the web. The carriage then decelerates and reverses, moving rapidly back to its starting position ready for the next cycle.

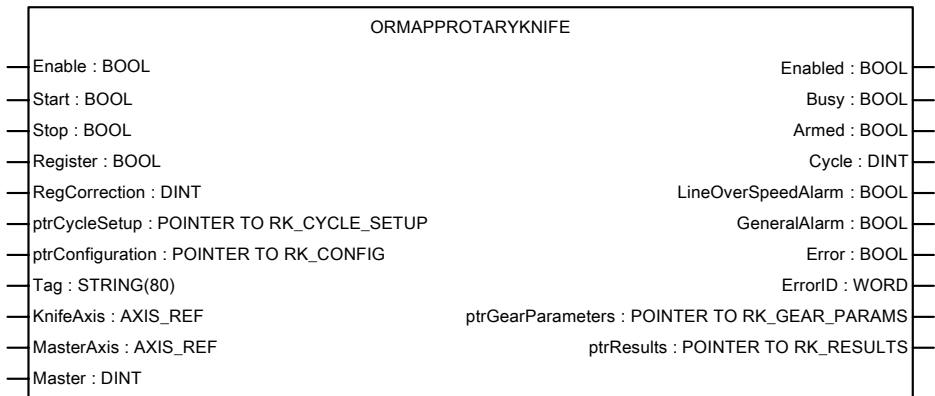


Note

- Application specific function blocks are available at a nominal charge.
- Custom application specific function blocks can be developed at a nominal charge. For details, contact Festo at 1.800.99.FESTO.

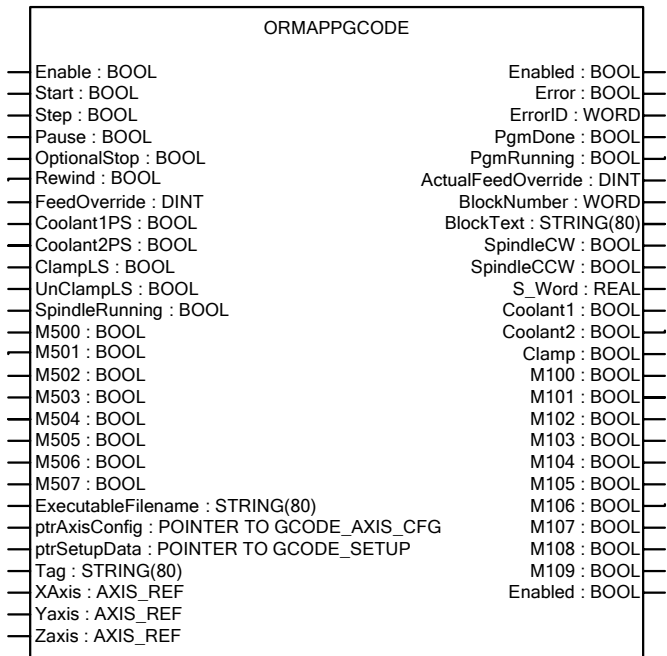
Rotary Knife Application Function Block

This function block makes it easy to implement a full-featured Rotary Knife application with a minimum of programming. Rotary Knives are used to cut, emboss, print or apply other processes to a moving web. The knife axis, which has one or more blades or dies equally spaced around its circumference, matches the web speed while making a cut or impression. Since the product length is seldom equal to the circumference, the knife must speed up or slow down when the die is not in contact with the web in order to achieve the correct product length.



G-Code to Motion Application Function Block

Applications such as gluing, welding, pattern cutting, gasket laying and textile cutting often require continuous path contoured motion of the type most easily programmed using G-code programming. The OrmAppGcode function block provides a simple way to incorporate path following in your application.



Note

- Application specific function blocks are available at a nominal charge.
- Custom application specific function blocks can be developed at a nominal charge. For details, contact Festo at 1.800.99.FESTO.

Function Blocks

New application specific function blocks will be posted as they are made available. Please go to www.festo.com/us/m&c/smlc.

Yaskawa Motors – Sigma II Series (Incremental Encoder Feedback)

Listed below are the supported Yaskawa motors and associated ServoWire drives.

Yaskawa Motor Model	ServoWire Drive
SGMPH-01BAE*	SEC-SDDE2/4-SA
SGMPH-01AAE	SEC-SDDE2/4-SA
SGMPH-02BAE*	SEC-SDDE4/7-SA
SGMPH-02AAE	SEC-SDDE2/4-SA
SGMPH-04AAE	SEC-SDDE4/7-SA
SGMPH-08AAE	SEC-SDDE4/7-SA
SGMPH-15AAE	SEC-SDDE8/14-SA
SGMSH-05ACA	SEC-SDDE8/14-SA
SGMSH-09ACA	SEC-SDDE14/24-SA
SGMGH-05ACA	SEC-SDDE4/7-SA
SGMGH-09ACA	SEC-SDDE8/14-SA
SGMGH-13ACA	SEC-SDDE14/24-SA

* 100 V motors

Yaskawa Motors – Sigma II Series (Absolute Encoder Feedback)

Listed below are the supported Yaskawa motors and associated ServoWire drives.

Yaskawa Motor Model	ServoWire Drive
SGMPH-01B1E*	SEC-SDDE2/4-SA
SGMPH-01A1E	SEC-SDDE2/4-SA
SGMPH-02B1E*	SEC-SDDE4/7-SA
SGMPH-02A1E	SEC-SDDE2/4-SA
SGMPH-04A1E	SEC-SDDE4/7-SA
SGMPH-08A1E	SEC-SDDE4/7-SA
SGMPH-15A1E	SEC-SDDE8/14-SA
SGMSH-05A2A	SEC-SDDE8/14-SA
SGMSH-09A2A	SEC-SDDE14/24-SA
SGMGH-05A2A	SEC-SDDE4/7-SA
SGMGH-09A2A	SEC-SDDE8/14-SA
SGMGH-13A2A	SEC-SDDE14/24-SA

* 100 V motors

Note

Yaskawa motors with absolute encoder feedback are supported but requires a battery internal to the drive unit (SEC-SDDEx/x-SA). Such requirements would be treated as a special request (SEC-SDDEBx/x-SA).

Wago I/O – 750 Series

The SEC-AC-SMLC Multi-axis Controller supports the Wago 750 series:

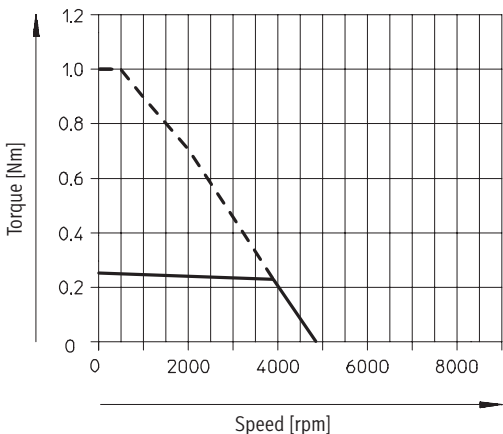
- Fieldbus Coupler Kits
- Digital Input Modules
- Digital Output Modules
- Analog I/O Modules
- Analog Output Modules
- Specialty Modules

Festo Servo Motor Performance Data (110 VAC)

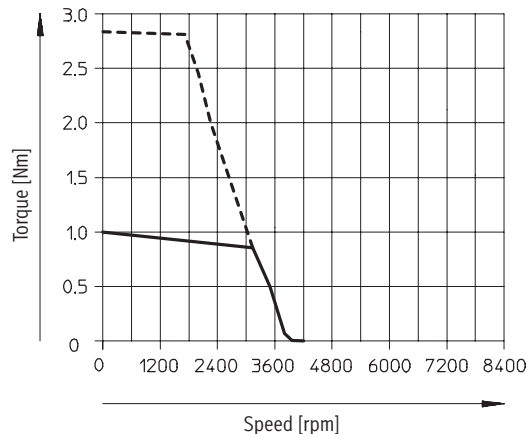
Engineering Support

Torque as a Function of Speed

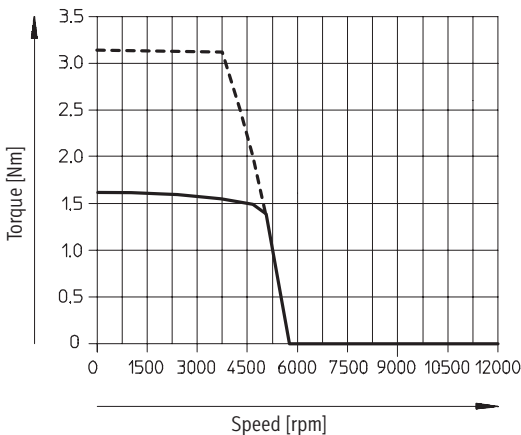
MTR-AC-40-...



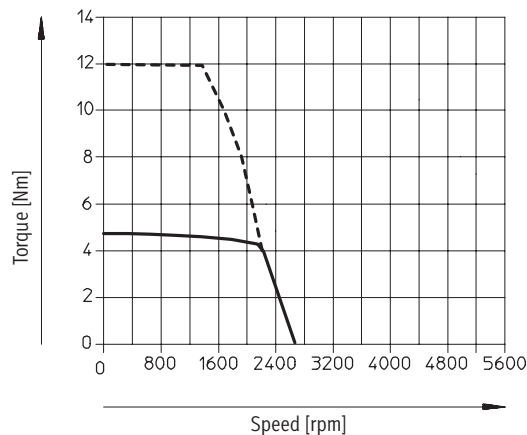
MTR-AC-55-...



MTR-AC-70-...



MTR-AC-100-...-3S



— Nominal torque
- - - Peak torque

Note: these are calculated curves, the actual motor performance might vary up to 5%.

Note

Characteristic curves apply to motors without gear unit. The gear unit data must be taken into consideration for motors with gear unit.

Example

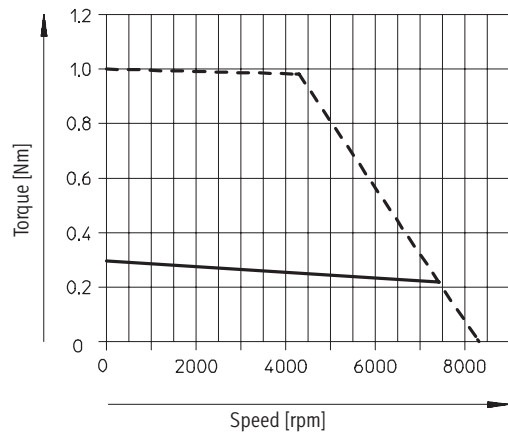
Nominal torque for motor MTR-AC-55-3S-... at a nominal speed of 3000 rpm

Without Gear Unit:
Nominal torque = 0.88 Nm
(see characteristic curve)

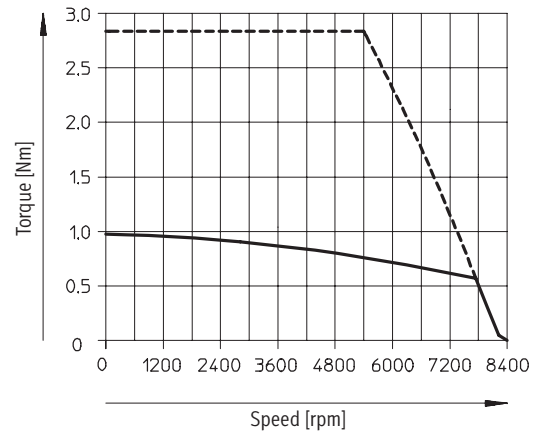
With Gear Unit:
Gear reduction ratio = 4:1
Gear unit efficiency = 0.95
Nominal rpm = $3000/4 = 750$
Nominal torque = $0.88 \text{ Nm} \times 4 \times 0.95 = 3.34 \text{ Nm}$

Torque as a Function of Speed

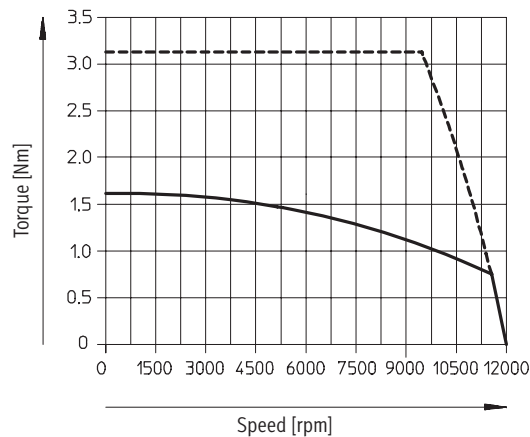
MTR-AC-40-...



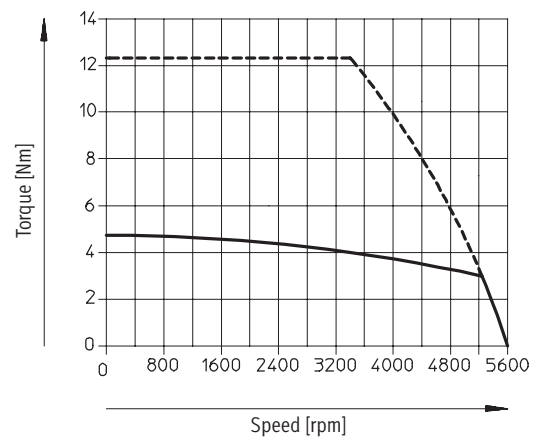
MTR-AC-55-...



MTR-AC-70-...



MTR-AC-100-...-3S



— Nominal torque
- - - Peak torque

Note

Characteristic curves apply to motors without gear unit. The gear unit data must be taken into consideration for motors with gear unit.

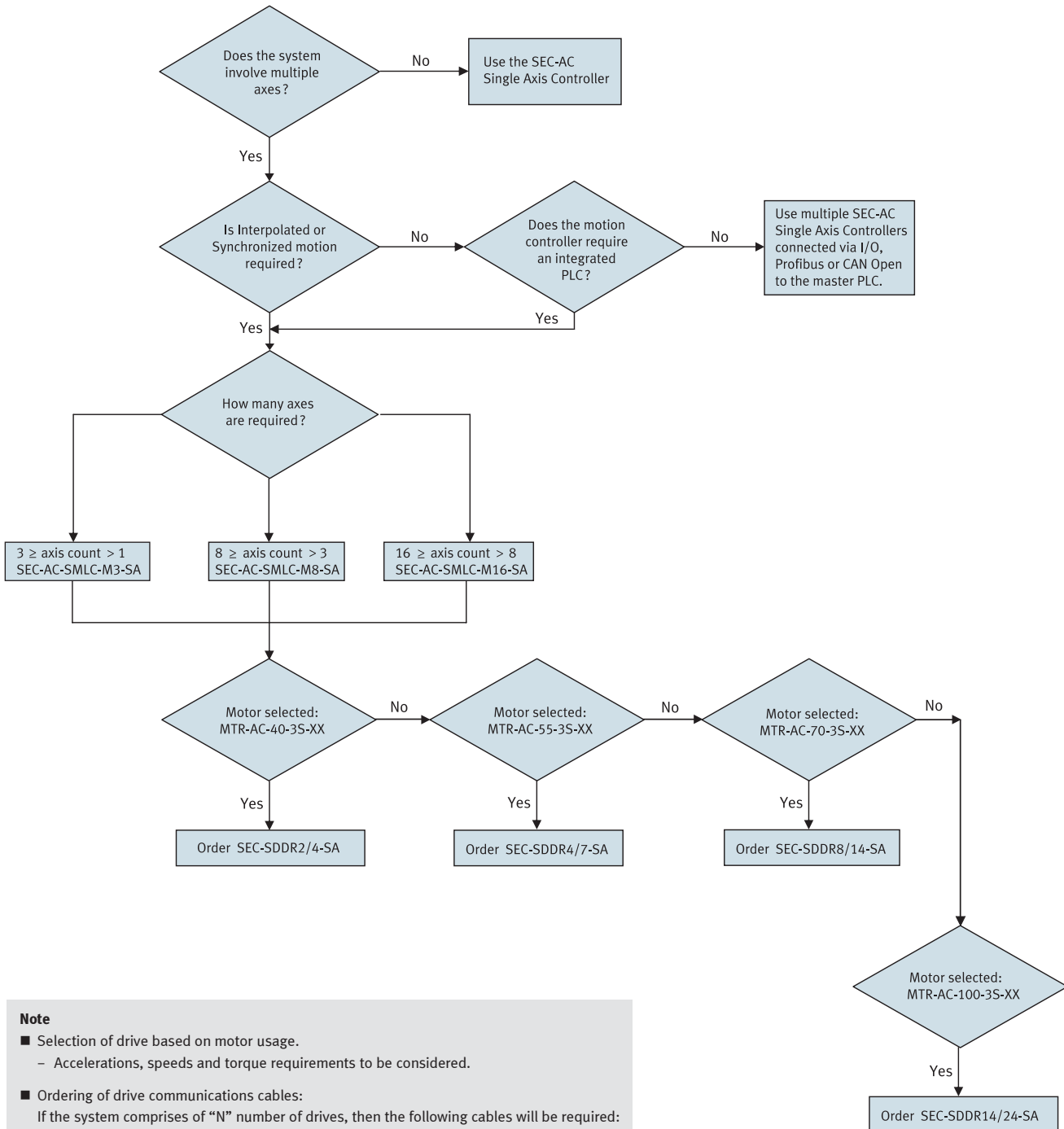
Example

Nominal torque for motor MTR-AC-55-3S-... at a nominal speed of 6800 rpm

Without Gear Unit:
Nominal torque = 0.66 Nm
(see characteristic curve)

With Gear Unit:
Gear reduction ratio = 4:1
Gear unit efficiency = 0.95
Nominal rpm = $6800/4 = 1700$
Nominal torque = $0.66 \text{ Nm} \times 4 \times 0.95 = 2.5 \text{ Nm}$

System Selection Guide



Note

- Selection of drive based on motor usage.
 - Accelerations, speeds and torque requirements to be considered.
- Ordering of drive communications cables:

If the system comprises of “N” number of drives, then the following cables will be required:

 - 1 pc Bilingual ServoWire Cable (between the controller and first drive)
 - N-1 pc Standard ServoWire Cable (between two consecutive drives)
- Ordering of motor power and resolver cables, each motor requires:
 - 1 motor power cable KMTR-AC...
 - 1 motor resolver cable KRES-AC...
 - or
 - 1 motor cable set KSEC-AC...
- A one-time purchase of programming software (CoDeSys) is required.
 - This CD includes the drive configuration software ServoWire Pro.

Example #1

System Description: Three axis linear gantry

X axis:	Motor:	MTR-AC-3S-70-GA (without brake)
	Homing:	To a sensor
	Motor cables:	Motor is stationary so Hi-Flex cables are not required
	Over Travel sensors:	Required at both ends of linear axis
Y axis:	Motor:	MTR-AC-3S-55-AA (without brake)
	Homing:	To a sensor
	Motor cables:	Hi-Flex cables are required
	Over Travel sensors:	Required at both ends of linear axis
Z axis:	Motor:	MTR-AC-3S-40-AB (with brake)
	Homing:	To a hard stop
	Motor cables:	Hi-Flex cables are required
	Over Travel sensors:	Required at both ends of linear axis

Required BOM For Example #1

Type Code	Description	Part No.	Qty	Function
SEC-AC-SMLC-M3-SA	Motion Controller	13039603	01	Controller (3-axis)
SEC-SDDR8/14-SA	ServoWire Drive	13039608	01	Drive for X axis
SEC-SDDR4/7-SA	ServoWire Drive	13039607	01	Drive for Y axis
SEC-SDDR2/4-SA	ServoWire Drive	13039606	01	Drive for Z axis
KSDD-CLR-SW1-SA	ServoWire Bilingual cable 1m	13039612	01	Comm. Cable: Controller to drive
KSDD-SDD-SW1-SA	ServoWire Cable 1m	13039610	02	Comm. Cable: Drive to drive
KSEC-AC-S-3-SA	Cable set for motor (Standard) 3m	13040215	01	Cable set for X axis
KSEC-AC-F-5-SA	Cable set for motor (Hi-Flex) 5m	13040219	02	Cable set for Y & Z axis
P.SW-CDK-SA	CoDeSys Development Kit, CD-ROM*	13039641	01	Programming /Config. Software
SEC-SDD-BRK	Brake Unit Kit (optically isolated relay with diode)	13049327	03	For motor brake (Z axis)
DIOK-CONN-A-SDD-SA	I/O Connector with Cable for SEC-SDD Drives	13049328	01	For drive I/O connections
KDIO-SMLC-5-SA	Digital I/O Cable for SEC-AC-SMLC, 5 m	13039973	01	Cable for I/O connection to controller

Example #2

System Description: Six-axis system with three pairs of synchronized axes. This system requires interfacing to several Profibus slave devices.

Axes 1 to 4:	Motor:	MTR-AC-3S-70-AB (with brake)
	Homing:	To a sensor
	Motor cables:	Motor is stationary so Hi-Flex cables are not required
	Over Travel sensors:	Required at both ends of linear axis
Axes 5 and 6:	Motor:	MTR-AC-3S-55-AB (with brake)
	Homing:	To a sensor
	Motor cables:	Motor is stationary so Hi-Flex cables are not required
	Over Travel sensors:	Required at both ends of linear axis

Required BOM For Example #2

Type Code	Description	Part No.	Qty	Function
SEC-AC-SMLC-M8-PB-SA	Motion Controller with Profibus Master	13040198	01	Controller (8 axis)
SEC-SDDR8/14-SA	ServoWire Drive	13039608	04	Drives for axes 1 to 4
SEC-SDDR4/7-SA	ServoWire Drive	13039607	02	Drives for axes 5 and 6
KSDD-CLR-SW1-SA	ServoWire Bilingual cable 1m	13039612	01	Comm. Cable: Controller to drive
KSDD-SDD-SW2-SA	ServoWire Cable 2m	13039611	05	Comm. Cable: Drive to drive
KSEC-AC-S-5-SA	Cable set for motor (Standard) 5m	13040216	06	Cable set for all axes
P.SW-CDK-SA	CoDeSys Development Kit, CD-ROM*	13039641	01	Programming /Config. Software
DIOK-CONN-A-SDD-SA	Brake Unit Kit (optically isolated relay with diode)	13049328	06	For motor brake (all axes)
SEC-SDD-BRK	I/O Connector with Cable for SEC-SDD Drives	13049327	06	For drive I/O connections
KDIO-SMLC-5-SA	Digital I/O Cable for SEC-AC-SMLC, 5 m	13039973	01	Cable for I/O connection to controller

Note

- Line Filters SEC-SDD-LF... (optional) are recommended. Multiple SEC-SDD drives may share one line filter (per cabinet). For sizing guideline, see page 39.
- Regen Resistors SEC-SDD-RR... (optional) are required in applications dealing with large inertial loads operating at high speeds. For sizing guideline, see page 39.
- Order sensors for homing and over-travel protection (on linear axes): SIEN, SMT-8, SME-8 (see page 38).

Recommended Festo Sensors				
Function	Type Code	Part Number	Description	External Pull-down Resistor Requirements [kΩ]
Over Travel Limit Sensors on Drive	SIEN-M8B-PS-K-L	150386	Inductive sensor M8, PNP, NO, 3 wire	3 - 6
	SIEN-M8B-PS-S-L	150387	Inductive sensor M8, PNP, NO, 3 pin	3 - 6
	SIEN-M8B-NO-K-L	150388	Inductive sensor M8, NPN, NC, 3 wire	None
	SIEN-M8B-NO-S-L	150389	Inductive sensor M8, NPN, NC, 3 pin	None
	SMT-8-PS-K-LED-24-B	175436	Magneto- resistive, Slot, PNP, NO, 3 wire	3 - 6
	SMT-8-PS-S-LED-24-B	175484	Magneto- resistive, Slot, PNP, NO, 3 pin	3 - 6
	SME-8-K-LED-24	150855	Magnetic Reed, Slot, NO, 3 wire	None
	SME-8-S-LED-24	150857	Magnetic Reed, Slot, NO, 3 pin	None
	SME-8-O-K-LED-24	160251	Magnetic Reed, Slot, NC, 3 wire	None
High Speed Sensor/General Input on Drive	SIEN-M8B-PS-K-L	150386	Inductive sensor M8, PNP, NO, 3 wire	5 - 10
	SIEN-M8B-PS-S-L	150387	Inductive sensor M8, PNP, NO, 3 pin	5 - 10
	SIEN-M8B-PO-K-L	150390	Inductive sensor M8, PNP, NC, 3 wire	5 - 10
	SIEN-M8B-PO-S-L	150391	Inductive sensor M8, PNP, NC, 3 pin	5 - 10
	SIEN-M8B-NS-K-L	150384	Inductive sensor M8, NPN, NO, 3 wire	None
	SIEN-M8B-NS-S-L	150385	Inductive sensor M8, NPN, NO, 3 pin	None
	SIEN-M8B-NO-K-L	150388	Inductive sensor M8, NPN, NC, 3 wire	None
	SIEN-M8B-NO-S-L	150389	Inductive sensor M8, NPN, NC, 3 pin	None
	SMT-8-PS-K-LED-24-B	175436	Magneto- resistive, Slot, PNP, NO, 3 wire	5 - 10
	SMT-8-PS-S-LED-24-B	175484	Magneto- resistive, Slot, PNP, NO, 3 pin	5 - 10
	SMT-8-NS-K-LED-24-B	171180	Magneto- resistive, Slot, NPN, NO, 3 wire	None
	SMT-8-NS-S-LED-24-B	171181	Magneto- resistive, Slot, NPN, NO, 3 pin	None
	SME-8-K-LED-24	150855	Magnetic Reed, Slot, NO, 3 wire	None
	SME-8-S-LED-24	150857	Magnetic Reed, Slot, NO, 3 pin	None
	SME-8-O-K-LED-24	160251	Magnetic Reed, Slot, NC, 3 wire	None
General Purpose Inputs on Drive or SMLC Controller	SIEN-M8B-PS-K-L	150386	Inductive sensor M8, PNP, NO, 3 wire	3 - 6
	SIEN-M8B-PS-S-L	150387	Inductive sensor M8, PNP, NO, 3 pin	3 - 6
	SIEN-M8B-PO-K-L	150390	Inductive sensor M8, PNP, NC, 3 wire	3 - 6
	SIEN-M8B-PO-S-L	150391	Inductive sensor M8, PNP, NC, 3 pin	3 - 6
	SIEN-M8B-NS-K-L	150384	Inductive sensor M8, NPN, NO, 3 wire	None
	SIEN-M8B-NS-S-L	150385	Inductive sensor M8, NPN, NO, 3 pin	None
	SIEN-M8B-NO-K-L	150388	Inductive sensor M8, NPN, NC, 3 wire	None
	SIEN-M8B-NO-S-L	150389	Inductive sensor M8, NPN, NC, 3 pin	None
	SMT-8-PS-K-LED-24-B	175436	Magneto- resistive, Slot, PNP, NO, 3 wire	3 - 6
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	SME-8-O-K-LED-24	160251	Magnetic Reed, Slot, NC, 3 wire	None

Regen Resistor/Drive Compatibility				
Regen Resistor Model	Resistance [Ω]	Rated Power [Watts]	Drives SEC-SDDR8/14-SA SEC-SDDE8/14-SA	Drives SEC-SDDR14/24-SA SEC-SDDE14/24-SA
SEC-SDD-RR-55	50	55	***	*
SEC-SDD-RR-95	40	95	N/A	***
SEC-SDD-RR-230	81	230	*	*
SEC-SDD-RR-650	72	648	*	*
SEC-SDD-RR-700	54	700	**	*
SEC-SDD-RR-845	40	845	N/A	**

Key

* Compatible

** Peak Regen capacity of the drive

*** Limited by the resistor

Suitable for typical point-to-point motion
Suitable for continuous regenerative and overhauling loads

Line Filter Sizing and Selection Recommendations

In the case of a system using multiple SEC-SDD ServoWire drives, they may share one line filter per cabinet. When selecting the line filter size, the fact that all drives/motors will not be operating at the same time needs to be taken into account.

Drive			Line Filter		
SEC-SDD ServoWire Drive	Mains Power	Drive Rated Output Power kVA	Line Filter	Continuous Current @ 230 VAC	Rated Power kVA @ 230 VAC
SEC-SDDR2/4-SA SEC-SDDE2/4-SA	115 VAC, 1 Ph 230 VAC, 1 Ph	0.29 0.59	SEC-SDD-LF15 [1 Ph]	Up to 15 A	3.45
SEC-SDDR4/7-SA SEC-SDDE4/7-SA	115 VAC, 1 Ph 230 VAC, 1 Ph	0.49 0.98	SEC-SDD-LF30 [1 Ph]	Up to 30 A	6.90
SEC-SDDR8/14-SA SEC-SDDE8/14-SA	115 VAC, 1 Ph 230 VAC, 1 Ph 230 VAC, 3 Ph	0.58 1.17 1.95	SEC-SDD-LF30X [3 Ph]	Up to 30 A	11.70
SEC-SDDR14/24-SA SEC-SDDE14/24-SA	115 VAC, 1 Ph 230 VAC, 1 Ph 230 VAC, 3 Ph	0.98 1.97 3.32	SEC-SDD-LF30X [3 Ph]	Up to 30 A	11.70

System Examples

Example #1

A three-axis system comprising of two SEC-SDDR2/4-SA drives and one SEC-SDDR8/14-SA drive, all operating on 115 VAC single-phase.

– Line filter required: One SEC-SDD-LF15

$$[0.29 \times 2 + 0.58 = 1.16 \text{ kVA}]$$

Example #2

An eight-axis system comprising of eight SEC-SDDR14/24-SA drives operating on 230 VAC, three-phase.

– Line filter required: SEC-SDD-LF30X (one filter would be required if 4 drives are operating at a time).

$$[3.32 \times 8 \times 1.7321 = 46 \text{ kVA assuming all 8 drives operate simultaneously.}]$$

If 4 drives operate at a time, the power dissipation would be 11.5 kVA]

A

Absolute encoder

A position feedback device employed in motion control systems to maintain a given mechanical location. The output of an absolute encoder is representative of the absolute position of the motor shaft within one (or more - in the case of a multi-turn encoder) revolutions. Output is usually a parallel digital word.

Axis

In motion control, this term normally refers to one of the servomotors in the system, either by name or Axis ID from 1 to 16. It is also used to refer to any Master (Pacer) Encoders in the system

C

CoDeSys

Controller Development System. The IEC-61131-3 runtime system developed by 3S Software used on the SMLC.

CoDeSys IDE

The CoDeSys Integrated Development Environment is the Win32 based application that allows you to develop, download and debug SMLC programs.

Command update rate

The rate at which the commands will be sent from the motion controller to the drive.

Coordinated motion

Multi-axis motion where the position of each axis is dependent on the other axis, such that the path and velocity of a move can be accurately controlled.

E

Electronic cam

A technique used to perform non linear motion electronically similar to that achieved with mechanical cams.

Electronic gearing

A method that simulates mechanical gears by electrically synchronizing one closed loop axis to a second axis (open or closed loop) through a variable ratio.

Electronic line shaft

A virtual axis that is used as the master axis on a machine to which other axes are synchronized by electronic gearing or camming profiles.

Electromagnetic compatibility

EMC is the ability of a device or a system to operate satisfactorily in its electro-magnetic environment without emitting unacceptable electro-magnetic interference to other devices.

Encoder resolution

Measure of the smallest positional change which can be detected by the encoder.

F

Follower

A servo axis, which is controlling its motion as a function of motion data, generated by a pacer axis.

Following error

The difference between the commanded position of an axis and its actual position. The amount of following error present varies with the speed of the axis.

FireWire

Bus standard for industrial applications and digital data exchange at high speed between various devices (IEEE 1394).

Feed Forward

A technique used to pre-compensate a control loop for known errors due to motor, drive, or load characteristics. Provides improved response. This technique depends only on the command and not the error.

H

Home Position

A reference position in a motion control system derived from a mechanical datum or switch.

I

IEC-61131-3

A global standard defining programming languages for industrial control.

Incremental encoder

A type of feedback device which converts mechanical motion into electrical signals (pulses) to indicate motor shaft position. By counting these pulses the motor shaft position can be determined. The frequency of the pulses reflects the speed at which the motor is rotating. Encoders with quadrature output provide information on the direction of motion using the phase relationship of the two channels.

Interpolation

Internal calculation by the controller of intermediate points on a path in a time grid. The path is pre-defined with interpolation points. The intermediate points can be on a straight line (linear interpolation), on a circle (circular interpolation), or on a parabola (parabolic interpolation). The path data is used for simultaneous control of motion axes.

L

Loop update rate (loop closure)

The rate at which the torque, velocity and position loops are closed in the drive. Loop update involves the regulation of the commanded and the actual variable (torque, position, or velocity) in order to minimize the error between the actual and commanded variable.

M

Master axis

Motion axis in a drive system which controls the synchronized motion of at least one drive axis.

MODBUS

The MODBUS® Protocol is a messaging structure developed by Modicon in 1979, to establish master-slave/client-server communication between intelligent devices. It is a de facto standard, truly open and a widely used network protocol in the industrial manufacturing environment.

MODBUS/TCP

Modbus/TCP is an implementation of the MODBUS Protocol, allowing MODBUS messages to be transferred via Ethernet.

N

Noise

An unwanted electrical signal. Typically from RFI or EMI induced onto the drive's components, speed reference or feedback wiring, and can cause the axis to react unexpectedly. Sources of noise are AC power lines, motors, generators, transformers, fluorescent lights, CRT displays, and radio transmitters.

O

OPC

OLE for Process Control. A set of open standards for connectivity and interoperability of industrial automation and enterprise systems.

P

Pacer encoder

An incremental encoder or device that generates quadrature signals which are used by other servo axes when they operate as followers.

PLCopen

Association of manufacturers and users of programming logic controllers and programming systems to promote the IEC 1131-3 standard (PLC programming) and certify programming systems based on it. This includes the definition of various compliance levels as well as the development of test procedures and the award of certificates by independent institutions. The programming language IEC 61131-3 is also substantially supported.

Q

Quadrature

Quadrature or "phase quadrature" signals are the most commonly used method of electronically determining or transmitting bidirectional position information. The two-quadrature signals are digital square waves, which have their cycles displaced 90 degrees (of the 360 electrical degrees in the repeated waveform). All four edges of the two digital signals are normally used for the maximum possible position resolution ("4X").

R

RTOS

Real-Time Operating System.

Regeneration

Usually refers to a circuit in a drive amplifier that accepts and drains energy produced by a rotating motor either during deceleration or free-wheel shutdown. In some systems, this regen power can be used by other axis.

Registration control

The act of maintaining a fixed position relationship between machine tooling and a product in the machine. Registration is normally measured by capturing the tooling position with respect to the product using a registration sensor of some type. It is controlled by phasing the tooling ahead or behind based on the difference between the actual and desired positional orientation.

Resolver

A position transducer used to determine the position of a motor. Resolvers are rotary transformer devices with analog interfaces. However, in Festo motion control systems which use resolvers, the servodrive decodes the resolver position digitally.

S

S curve

S curve refers to a control pattern that accelerates and decelerates a motor slowly to reduce mechanical shock.

Servo motor

A motor which is used in closed loop systems where feedback is used to control motor velocity, position, or torque.

Servo drive

A motor drive which utilizes internal feedback loops for accurate control of motor current and/or velocity. It is the electronics which convert low level command signals to high power voltages and currents to operate a servomotor.

Slave axis

A motion axis that is derived and driven by synchronization with the master axis.

Synchronization

The condition that occurs when several axes follow a common control signal and are in a specific position or at a specific speed according to the signal.

T

TCP/IP

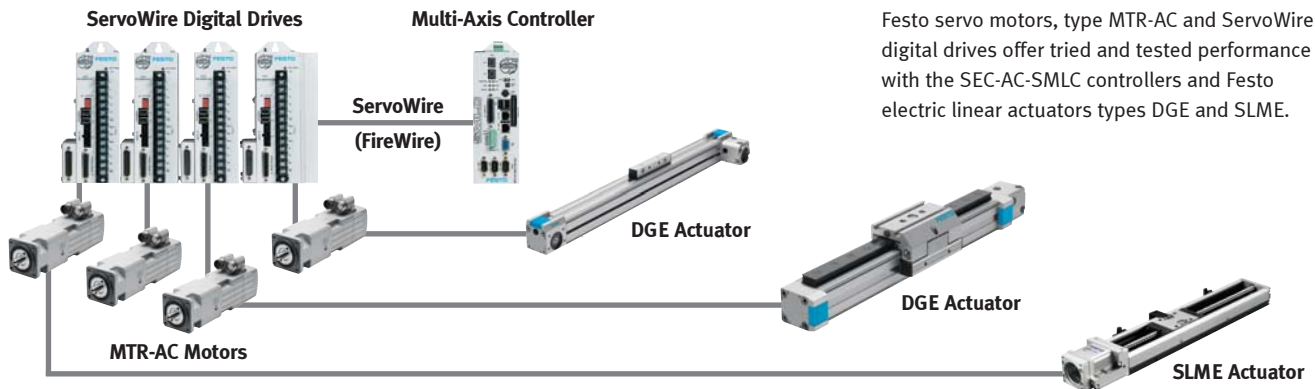
Transmission Control Protocol over Internet Protocol. The de facto standard Ethernet protocol.

Tension control

Using Tension feedback to control the velocity of a servomotor.

Tuning

In a servo system, the process of optimizing loop parameters to achieve the desired response from a stage or mechanism from an input command.



DGE Electric Linear Actuators



Ball Screw Driven Linear Actuators

- Sizes: 18, 25, 40, 63 mm
- Stroke lengths up to 2 m
- Maximum speed: 1.2 m/s
- Repeatability of ± 0.02 mm
- Axial force up to 1,600 N

Belt Driven Linear Actuators

- Sizes: 8, 12, 18, 25, 40, 63 mm
- Stroke lengths up to 5 m
- Maximum speed: 10 m/s
- Repeatability of ± 0.10 mm
- Axial force up to 1,500 N

Boom Axis

- Sizes: 18, 25, 40 mm
- Stroke lengths up to 1 m
- Maximum speed: 3 m/s
- Repeatability of ± 0.05 mm
- Axial force up to 1,000 N

Multi-axis Systems

Components and accessories to build:

- X/Y/Z Axis Systems
- Cantilever-type Handling Gantries
- Linear Gantries
- Planar Surface Gantries

SLME Electric Actuators



Ball Screw Driven Linear Actuators

- Sizes: 23, 30, 46 mm
- Stroke lengths up to 1000 mm
- Maximum speed: 1.05 m/s
- Repeatability of ± 0.005 mm
- Axial force up to 3,200 N
- Positioning accuracy to 0.060 mm
- Maximum dynamic load of 27 kN

Design Features

- Compact via gothic arch bearing configuration
- Minimal deflection with steel U-shaped guide rail
- Corrosion resistant surfaces ensure predictable life
- Cleanroom compatible with C-Grease lubrication
- Optional dust cover protects ball bearings from debris

Applications

- Semiconductor manufacturing
- Medical devices and laboratory automation
- Easy-to-install/configure into single or multi-axis systems
- Compact design for envelope constraints
- Adheres to high quality control standards

MTR-AC Servo Motors



Overview

- Sizes: 40, 55, 70, 100 mm
- With holding brake and gearbox options
- Rotor position sensor: resolver
- c UL us - recognized (OL)
- CE symbol according to EU low voltage guidelines

MTR-AC-40-...

- Max. speed: 10,400 1/min
- Nominal speed: 6,000 1/min
- Peak torque: 1 Nm
- Nominal torque: 0.24 Nm
- Standstill torque: 0.27 Nm

MTR-AC-55-...

- Max. speed: 8,090 1/min
- Nominal speed: 6,800 1/min
- Peak torque: 2.8 Nm
- Nominal torque: 0.66 Nm
- Standstill torque: 0.98 Nm

MTR-AC-70-...

- Max. speed: 11,640 1/min
- Nominal speed: 6,250 1/min
- Peak torque: 3.1 Nm
- Nominal torque: 1.4 Nm
- Standstill torque: 1.64 Nm

MTR-AC-100-...

- Max. speed: 4,550 1/min
- Nominal speed: 3,600 1/min
- Peak torque: 23 Nm
- Nominal torque: 6.36 Nm
- Standstill torque: 12.53 Nm

Product Range and Company Overview

Supporting Advanced Automation... As No One Else Can

Festo is a leading global manufacturer of pneumatic and electromechanical systems, components and controls for industrial automation, with 56 national headquarters serving more than 180 countries. For more than 80 years, Festo has continuously elevated the state of manufacturing with innovations and optimized motion control solutions that deliver higher performance, more profitable automated manufacturing and processing equipment. Our dedication to the advancement of automation extends beyond technology to the education of current and future automation and robotics designers with simulation tools, teaching programs, and on-site services.

Custom Automation Components



Custom Control Cabinets



Complete Systems



Custom Designed Automation Solutions

Our experienced engineers provide complete support at every stage of your development process, including: conceptualization, analysis, engineering, design, assembly, documentation, validation, and production.

Electromechanical



Pneumatics



PLCs and I/O Devices



Comprehensive Line of Automation Components

With a comprehensive line of more than 30,000 automation components, Festo can support the most complex automation requirements.

Quality Assurance, ISO 9001 Certification

Festo Corporation is committed to provide Festo products and services that will meet or exceed our customers' requirements in product quality, delivery, customer service and satisfaction.

All Festo locations within the United States are registered to ISO 9001.

FESTO



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